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THE PHYSICO-CHEMICAL VALORATION OF TIKITIKI EXTRACT [1]

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For a long time this country has been paying very dearly for exotic drugs. At present, however, there is the praiseworthy tendency to utilize our own resources in the preparation of the medicines used in combating the diseases peculiar to this part of the world.

The extract of tikitiki,[2] although recognized and prescribed for a number of years, has not usually been prepared according to any definite, standard method. Hence, differences in composition are found in the several brands that may be obtained in the market; that is, the products show different proportions as to their components. Consequently, we believe that our scientific authorities should adopt an official method for the preparation of this extract that would comply with established physical and chemical principles. The compound that we are considering as a standard is the one exemplified by the extract prepared by the Bureau of Science, Manila, according to the method of Chamberlain and Vedder,[3] which is the one used in this laboratory.

No definite conclusions leading to the formulation of a standard extract of this drug can be drawn from the results obtained in

[1] From the laboratory of pharmaceutical chemistry, School of Pharmacy, University of the Philippines.

[2] Tikitiki is the Philippine word meaning rice polishings.

[3] Chamberlain, Weston P., and Vedder, Edward B., The cure of infantile beriberi by the administration to the infant of an extract of rice polishings, and the bearing thereof on the etiology of beriberi, *Bull. Manila Med. Soc.* 4 (1912) 26.

our analytical work on the different brands of tikitiki extract as prepared in local drug stores and private laboratories. However, inspection of the results shows that extracts 1, 2, and 3 are of approximately equal concentration, while extracts 4 and 5 occur as much lower concentrations, this being shown by their specific gravity and the proportions of total solids they contain. The results of our analyses are summarized in Table I.

TABLE I.—*Results of analyses of samples of tikitiki extract.*

	Bureau of Science, extract 1.	Extract 2.	Extract 3.	Extract 4.	Extract 5.
Temperature ----------°C--	28 to 25	26 to 25	30.3 to 30.1	28.5 to 30.1	29.3 to 29.6
Specific gravity----------	1.2800	1.2960	1.2878	1.2254	0.9572
Total solids------per cent--	53.23	56.20	50.33	25.53	5.40
Reducing sugar (by direct reduction)-----per cent--	23.70	20.80	24.96	15.27	1.39
Disaccharides (saccharose by inversion)--per cent--	2.56	0.30	0.65	0.57	0.17
Mineral residue-----do-----	4.40	3.32	4.87	0.76	0.19
Total nitrogen by Kjeldahl ----------per cent--	2.008	2.300	1.640	0.856	0.140
Phosphorus as P_2O_5-do-----	1.70	0.375	2.14	0.24	0.165
Sulphur (total) -----do-----	0.26	0.109	1.11	0.059	0.001
Amylolytic enzyme--------	negative	negative	negative	negative	negative

A striking fact in this table is that extract 3, which has a higher specific gravity than extract 1, has however a lower percentage of total solids than that extract. This fact might be accounted for by the different methods used in removing the alcohol from the extract and by the extent of its dilution with water so as to obtain it at the desired concentration. Furthermore, we have the anomalous condition shown in extract 5, in which a sample with 5.4 per cent of total solids shows, at 29.3° to 29.6° C., a specific gravity of 0.9572. This condition might be explained by the presence of an unremoved residuum of the alcohol that was used as a solvent.

The determination of total solids in vacuum is undoubtedly the most accurate method for collecting such data; but, regrettably, our electric pump was not in working order at the time we undertook this investigation and we were forced, therefore, to employ other methods to obtain our results.

The amounts of reducing sugar and disaccharides are practically proportional to the total solids. The proportion between them, however, is variable and depends upon the degree of their hydrolyzation. In extract 2, which was purposely hydrolyzed, the proportion of disaccharides is very small.

It is very remarkable that in the majority of the samples the proportion of nitrogen is higher than that of phosphorus. Extracts 3 and 5, however, show the reverse condition. The amount of phosphorus in extract 3 is one and one-fourth as great as the nitrogen found in the same sample, and compared with the phosphorus of extract 2 it is six times as high, while the standard sample of the Bureau of Science is one-fourth lower in phosphorus than extract 3.

We have obtained uniformly negative results in our attempts to demonstrate the amylolytic enzyme. We assume that the reason for this is that the treatment of the extract with alcohol renders the enzyme inactive.

The figures we have obtained must be considered as being merely approximate, for it is quite apparent that analyses of the different samples of the same manufacturer, prepared at different times, will of necessity yield results that will vary to some extent. This is not surprising in view of the lack of a standard method for the preparation of this drug, to which we already have called attention. In fact, even though the same general procedure were followed, any qualitative variation in the raw material used, the concentration of the alcoholic solvent, the time during which the solvent and drug are in contact, the temperature at which extraction takes place, and the time over which evaporation is allowed to proceed when the vacuum is not employed—all these are factors that must be taken into account in the determination of the percentage composition of the extract.

The above discussion regarding tikitiki extract has been advanced from the viewpoint of the chemist; but it should be well borne in mind that systematic clinical studies by the physician must be carried out and carefully interpreted before determination can be made of the most desirable composition and the ultimate standardization of this drug, now so generally administered in the treatment of endemic neuritis.

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ADDITIONAL NOTES ON THE KWANGTUNG FLORA

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This third paper on the flora of Kwangtung Province, China, is essentially like its predecessors.[1] In it have been included the descriptions of fifteen presumably new species, and records of thirty-four previously described forms either new to China or new to Kwangtung Province. The material on which these data are based has been collected by Mr. C. O. Levine and Mr. G. W. Groff, of the Canton Christian College, ably assisted by their Chinese collector To Kang P'eng.

In this paper have also been included some necessary changes in nomenclature for Chinese species occasioned by a recent preliminary study of Loureiro's Flora Cochinchinensis. This work was published in 1790. It contains the descriptions of one thousand two hundred ninety-four species and a few varieties, of which about six hundred thirty were described as new, the others ascribed to binomials established by Linnaeus. A preliminary examination of Loureiro's work shows that he frequently described some species twice, or sometimes even three or four times, under the same or under different generic names. In nearly one hundred cases reductions have been made, so that the total number of distinct species described by Loureiro is probably less than one thousand two hundred. In his interpretation of Linnean species he made numerous and frequently grave errors, and in about three hundred seventy cases, or about 56 per cent, he was wrong in the interpretation of such species. Loureiro described as new a total of one hundred eighty-five genera of which forty-two are generally adopted as valid ones or, if strict priority be followed, eliminating those names excluded by the lists of *nomina conservanda* adopted by the Vienna and the Brussels Botanical Congresses, fifty should be adopted. Fourteen of Loureiro's new genera have never been satisfactorily reduced and remain as doubtful ones.

[1] Merrill, E. D., Notes on the flora of Kwangtung Province, China, *Philip. Journ. Sci.* 12 (1917) Bot. 99–111; Notes on the flora of Loh Fau Mountain, Kwangtung Province, China, op. cit. 13 (1918) Bot. 123–161.

The title "Flora Cochinchinensis" is somewhat misleading, although more species were described from Cochin China than from any other single region. The geographic sources of his material are as follows: From Cochin China alone, about 697; from China alone, about 254; from both Cochin China and China, about 292; from tropical East Africa opposite Zanzibar, 29; from Mozambique, 9; from Zanzibar, 8; from India, 5; with 1 each from the Philippines, Sumatra, and the Malay Peninsula. Most of the Chinese material mentioned by Loureiro was from the immediate vicinity of Canton, where he resided for a period of three or four years.

In 1774 Loureiro mentions having sent about sixty specimens with descriptions to Europe, and in 1779 another lot of two hundred thirty specimens. I have not as yet succeeded in locating the first lot; the second shipment apparently consisted of those preserved in the herbarium of the British Museum. In the herbarium of the Paris Museum of Natural History ninety specimens from Loureiro are preserved, these having been secured by Geoffroy Saint-Hilaire in Lisbon in 1808. The bulk of Loureiro's collection, however, was retained by him in Lisbon and has long since been destroyed.[2]

Of the one thousand two hundred ninety-four species recognized by Loureiro not more than three hundred eighty are represented by known extant botanical material from his collections. In the much more numerous cases where Loureiro's types are no longer extant, the species must be interpreted from the original descriptions and such other data as can be secured for the regions in which the specimens were collected.

Considerable time was devoted to a preliminary study of Loureiro's species, and a manuscript commentary on the Flora Cochinchinensis was prepared by me and completed April 15, 1919. In this commentary Loureiro's species, so far as possible, were reduced to a family arrangement following the Engler and Prantl system. An attempt was made to determine the oldest valid specific name for each species and the necessary synonymy was added to explain the acceptance of the specific name in each case; all local names cited by Loureiro were recorded; and a more or less critical discussion of each species was given, together with the place of origin for each as cited by Loureiro. This manuscript was prepared in six copies, one of which is

[2] De Candolle, A, La Phytographie (1880) 430.

retained in Manila; one was sent to Dr. A. Chevalier, director of the Institut Scientifique in Saigon, Indo-China; one to the Canton Christian College, Canton, China; one to the library of the United States Department of Agriculture, Washington; one to the British Museum (Natural History), London; and one to the Muséum d'Histoire Naturelle, Paris. The essential object in preparing this manuscript was to establish a basis for further investigations regarding the status of Loureiro's species, as there still remains a high percentage of forms that are unintelligible from the descriptions alone. Eventually, when we shall have secured sufficient additional data to warrant doing so, it is hoped that a critical revision of Loureiro's species may be prepared and published.

The manuscript mentioned above summarizes in convenient form all the data at present available regarding the status of Loureiro's species in relation to those described by other authors, and from it can be determined those that are definitely known and those that are of a more or less doubtful status. Fourteen genera have not definitely been placed, of which twelve have not been referred to their proper families, while about three hundred seventy-five species are still more or less doubtful, and cannot, from the description alone, be safely correlated with those of other authors. Of these doubtful species many cannot be referred to their proper genera, and nearly fifty cannot be even referred to their proper families. Any great reduction in this rather high percentage of doubtful species cannot be expected until intensive field work shall have been prosecuted, with special reference to the problem, in southern China but more especially in Cochin China, in the vicinity of Hue where Loureiro resided.

GRAMINEAE

AGROPYRON Gaertner

AGROPYRON CILIARE (Trin.) Franchet in Nuov. Arch. Mus. Paris II 7 (1884) 151.

Triticum ciliare Trin. in Bunge Enum. Pl. Chin. Bor. (1831) 72.

Kwangtung Province, Shiuchow region, *To Kang P'eng 2827*, April, 1919.

A species of wide distribution in northern and central China but no representative of the genus hitherto recorded from as far south as Kwangtung.

ARACEAE

POTHOS Linnaeus

POTHOS REPENS (Lour.) comb. nov.

Flagellaria repens Lour. Fl. Cochinch. (1790) 212, ed. Willd. (1793) 263.

Pothos loureirii Hook. & Arn. Bot. Beechy's Voy. (1841) 220; Schott Aroid. 1 (1853) 23, *t. 49*, Prodr. (1860) 567; Engl. in DC. Monog. Phan. 2 (1879) 87; N. E. Br. in Journ. Linn. Soc. Bot. 36 (1903) 186, Curtis's Bot. Mag. *t. 7744;* Engl. Pflanzenreich 21 (1905) 35, *f. 15.*

Pothos terminalis Hance in Ann. Sci. Nat. V 5 (1866) 247.

Pothos microphyllus Schott Aroid. 1 (1853) 23, *t. 40, f. B.*

This species is known from Kwangtung Province, Hainan, and Tonkin, and is represented by *Levine 1989* from Teng Woo Mountain, Kwangtung Province, and by *Hongkong Botanic Garden 2243* from Hainan. The oldest valid specific name is here adopted, as Loureiro's description applies in all respects to the species as currently interpreted.

ARISAEMA Martius

ARISAEMA KWANGTUNGENSE sp. nov. § *Pedatisecta.*

Herba circiter 40 cm alta; foliis solitariis, pedatisectis, segmentis plerumque 11, omnibus sessilibus, lanceolatis, acuminatis, 6 ad 9 cm longis, 1 ad 1.8 cm latis, basi angustatis; scapus 15 ad 18 cm longus; spathae tubus 5 cm longus, cylindricus, deorsum leviter angustatus; lamina ovata ad oblongo-ovata, 4 ad 5.5 cm longa, usque ad 3 cm lata, tenuiter acuminata, basi rotundata; spadicis appendix usque ad 10 cm longa.

Corms unknown. Peduncular part of the plant 15 to 20 cm long, bearing one leaf and one inflorescence, the free petiolar part of the leaf 4 to 6 cm long. Leaves pedately lobed, the segments mostly 11, membranaceous, lanceolate, slenderly acuminate, narrowed below, all sessile, 6 to 9 cm long, 1 to 1.8 cm wide. Scape 15 to 18 cm long, smooth, slender. Spathe pale green, its tube cylindric, slightly narrowed below, 5 cm long, the lamina membranaceous, ovate to oblong-ovate, 4 to 5.5 cm long, up to 3 cm wide, base rounded, apex slenderly acuminate but not caudate. Spadices unisexual, the staminate ones about 3 mm in diameter, floriferous for a distance of about 3 cm, the appendage slender, smooth, up to 10 cm long, 1 to 1.3 mm in diameter.

Kwangtung Province, Shiuchow region, *Levine 3565*, May 3, 1919, scattered along roads northeast of Nam Wa monastery.

I am unable to refer this specimen to any previously described species. It is apparently allied to *Arisaema japonicum* Blume.

LILIACEAE

SCILLA Linnaeus

SCILLA SINENSIS (Lour.) comb. nov.

Ornithogallum sinense Lour. Fl. Cochinch. (1790) 206.
Barnardia scilloides Lindl. in Bot. Reg. *t. 1029.*
Scilla chinensis Benth. Fl. Hongk. (1861) 373.

Loureiro's species is manifestly identical with the one currently known as *Scilla chinensis* Benth., the latter having been published independently of *Convallaria chinensis* Osbeck [3] which is unquestionably a synonym although very imperfectly described. It is not uncommon in open grassy places in the vicinity of Canton whence Loureiro secured his material, and is represented by the following Kwangtung material: *Merrill 10048, Levine 3270, 3421,* the latter with the recorded local name *shik sun tau.*

DISPORUM Salisbury

DISPORUM CANTONIENSE (Lour.) comb. nov.

Fritillaria cantoniensis Lour. Fl. Cochinch. (1790) 206.
Disporum pullum Salisb. in Trans. Hort. Soc. 1 (1812) 331.
Uvularia chinensis Ker in Curtis's Bot. Mag. *t. 916.*

Loureiro's material was from plants cultivated in Canton, for which he cites the local name *lin ni hoa.* Wright [4] admits *Fritillaria cantoniensis* Lour. with the following comment: "A doubtful plant supposed by Gawler to be the same as *Uvularia chinensis,* which is now reduced to *Disporum pullum* Salisb." Hooker f.,[5] under *Disporum pullum* Salisb. states: "The type of this species is the Chinese *Uvularia chinensis* of the Botanical Magazine, a purple flowered plant hardly distinguishable from shortly spurred specimens of *calcaratum.*" Loureiro's description is ample and applies unmistakably to *Disporum;* his specific name should be retained for the Chinese form currently referred to *Disporum pullum* Salisb. I am by no means certain that all the Indo-Malayan material currently referred to *Disporum pullum* Salisb. is conspecific with the Chinese form.

[3] Dagbok Ostind. Resa (1757) 220.
[4] Journ. Linn. Soc. Bot. 26 (1903) 136.
[5] Fl. Brit. Ind. 6 (1892) 260.

ASPARAGUS Tournefort

ASPARAGUS COCHINCHINENSIS (Lour.) comb. nov.

Melanthium cochinchinense Lour. Fl. Cochinch. (1790) 216.
Asparagus lucidus Lindl. in Bot. Reg. (1844) Misc. 29.

Loureiro observed this species in both China and Cochin China, and his description applies unmistakably to the well-known *Asparagus lucidus* Lindl., in spite of his description of the fruit as a capsule, this being a manifest error on the part of Loureiro. Kwangtung material representing the species, and for which the Cantonese name *tin tung* is recorded, corresponding to the form Loureiro cites, *tien muen tum*, is as follows: *Merrill 10699, Levine 2174, Groff 2290, Dunn 6337.* I have also examined the following specimens: Hongkong, *Curran.* Hainan, *Miss Moninger 62.* Formosa, *Faurie 947, Bot. Inst. Tokyo 1570.*

ZINGIBERACEAE

PHRYNIUM Willdenow

PHRYNIUM PLACENTARIUM (Lour.) comb. nov.

Phyllodes placentaria Lour. Fl. Cochinch. (1790) 13.
Phrynium parviflorum Roxb. Fl. Ind. 1 (1820) 7; K. Schum. in Engl. Pflanzenreich 11 (1902) 54.

Loureiro observed this species both in China and in Cochin China. The generic name *Phyllodes* antedates *Phrynium*, but the latter is retained in the list of *nomina conservanda* adopted by the Vienna Botanical Congress. K. Schumann cites Loureiro's species as a doubtful synonym of *Phrynium capitatum* Willd., a purple-flowered species recorded from both China and Cochin China. From Loureiro's description of the flowers of his species as white I am convinced that he had specimens of the species currently known as *Phrynium parviflorum* Roxb., of which I have excellent specimens from Cochin China, *Pierre 626*, and from Kwangtung Province, China, *Levine 1873, Groff 2524*, with the recorded Cantonese name *chung ip*, corresponding to Loureiro's recorded Cantonese name *toung iep.*

ORCHIDACEAE

SPIRANTHES L. C. Richard

SPIRANTHES ARISTOTELIA (Raeusch.) comb. nov.

Epidendrum aristotelia Raeusch. Nomencl. ed. 3 (1797) 265.
Aristotelia spiralis Lour. Fl. Cochinch. (1790) 522.
Spiranthes australis Lindl. in Bot. Reg. (1824) sub *t. 823*, non Koch.
Neottia sinensis Pers. Syn. 2 (1807) 511.
Spiranthes sinensis Ames Orch. 2 (1908) 53.

Aristotelia spiralis Lour., described by him as a new genus and species, was based on specimens from the vicinity of Canton.

It is represented by the following Kwangtung material, *Levine 1014, 2036, 2072,* growing in open grasslands, flowering in April and May. The species is one of very wide distribution, extending from India to Japan southward to New Zealand. Loureiro's type is preserved in the herbarium of the Paris Museum of Natural History.

MORACEAE

ANTIARIS Leschenault

ANTIARIS TOXICARIA (Pers.) Lesch. in Ann. Mus. Paris 17 (1810) 478.
Ipo toxicaria Pers. Syn. 2 (1807) 566.

Kwangtung Province, Kochow region, *To Kang P'eng 2755,* at Koon Shan temple, west of Kochow city, with the local name *to yiuk.*

Widely distributed in the Indo-Malayan region, but no representative of the genus previously recorded from China. This is the "deadly upas tree," its milky juice being widely used in the Indo-Malayan region for the purpose of poisoning spears and arrows.

CUDRANIA Trécul

CUDRANIA PUBESCENS Tréc. in Ann. Sci. Nat. Bot. III 8 (1847) 125.

Kwangtung Province, Shiuchow region, Tan Ha Shan, *To Kang P'eng 2847,* April 25, 1919.

Yunnan Province, China, Burma, Java; new to Kwangtung.

FICUS Linnaeus

FICUS VARIEGATA Blume Bijdr. (1825) 459; King in Ann. Bot. Gard. Calcutta 1 (1888) 169, *t. 212.*

Kwangtung Province, Kochow region, Ngau Tsai Wan, *To Kang P'eng 2743,* February 25, 1919, with the local name *tong kwo muk.*

This is the typical form of Blume's species, with broad, undulate-toothed leaves and large fruits. It is certainly specifically distinct from *Ficus chlorocarpa* Benth. which King referred to Blume's species as a variety. *Ficus chlorocarpa* Benth. is represented by *Merrill 10262* and *Levine 1889* from Kwangtung Province.

FICUS BENJAMINA Linn. Mant. 1 (1767) 129; King in Ann. Bot. Gard. Calcutta 1 (1887) 43, *t. 52.*

Kwangtung Province, Kochow region, Tai Shek Ling, *To Kang P'eng 2663,* March 18, 1919, with the local name *sai ip yung.*

Wild in various parts of the Malayan region and the Philip-

pines, frequently planted in other parts of tropical Asia. Not before recorded from China proper, although known from Hainan.

LORANTHACEAE

LORANTHUS Linnaeus

LORANTHUS PENTANDRUS Linn. Mant. 1 (1767) 63; Blume Fl. Jav. Loranth. (1828) 33, *t. 10;* Hook. f. Fl. Brit. Ind. 5 (1886) 216.

Kwangtung Province, Sai Sha, Sz Ooi, *Groff 2403,* April 24, 1918.

This species has not previously been reported from China; the specimens agree closely with the descriptions and with our rather full series of Malayan specimens.

LORANTHUS PARASITICUS (Linn.) comb. nov.

Scurrula parasitica Linn. Sp. Pl. (1753) 110, excl. syn. Camell et Petiver.

Loranthus scurrula Linn. Sp. Pl. ed. 2 (1762) 472, non auct. plur.

Loranthus estipitatus Stapf. (p. p.) in Trans. Linn. Soc. Bot. 4 (1894) 221; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26 (1844) 405; Dunn & Tutcher Fl. Hongk. Kwangtung (1912) 229 (as to the Chinese plant).

Kwangtung Province, vicinity of Canton, *Merrill 9987, Levine 1277, 1866, 1948, Groff 2314.* Hongkong, *Hongkong Herbarium 1232.*

The history of this species is as follows: The original binomial, *Scurrula parasitica* Linn., was manifestly based on a specimen, indicated by Linnaeus as originating in China, and in all probability collected by Osbeck near Canton; to the species Linnaeus erroneously referred "*Viscum vitici innascens* Camell. luz. 3 n. 36. Pet. gaz. t. 23, f. 8." Camell's description was based on specimens from Naic, Cavite Province, Luzon, and is manifestly *Loranthus philippensis* Cham. & Schlecht., an endemic Philippine species. Petiver's figure was in all probability based on Camell's drawing or on specimens from him, and a copy of the figure kindly supplied by Mr. Oakes Ames shows that it also represents *Loranthus philippensis* Cham. & Schlecht. The Linnean description does not apply to *Loranthus philippensis* Cham. & Schlecht., but does apply word for word to the Chinese form currently referred to *Loranthus estipitatus* Stapf, which is the commonest species of *Loranthus* found in the vicinity of Canton, the region in which Osbeck botanized. It does not apply to *Loranthus scurrula* of modern authors. In the second edition of the Species Plantarum Linnaeus made *Scurrula parasitica* the

basis of a new binomial, *Loranthus scurrula* Linn., but the earlier specific name should be adopted.

Fragments of recently collected material, cited above, were sent to London and were critically compared by Doctor Stapf with the Linnean type and with the type of *Loranthus estipitatus* Stapf. He writes under date of May 31, 1918, that as a result of his comparison this Chinese form must be accepted as *Loranthus scurrula* Linn. [= *L. parasiticus* (Linn.) Merr.], but that it is distinct from *L. estipitatus* Stapf. *Loranthus chinensis* DC is closely allied, if not identical.

LORANTHUS LEVINEI sp. nov. § *Scurrula.*

Frutex parasiticus, ramis usque ad 60 cm longis, teretibus, glabris, minute lenticellatis, ramulis dense ferrugineo-puberulis; foliis oblongis, coriaceis, obtusis, basi obtusis ad rotundatis, usque ad 8 cm longis, supra glabris, nitidis, olivaceis, subtus densissime ferrugineo-puberulis vel tomentosis, nervis utrinque 4 ad 6, supra distinctis, subtus obscuris; floribus axillaribus, 4-meris, fasciculatis, circiter 2.5 cm longis, curvatis, densissime ferrugineo-tomentosis, pedunculis 1- ad 3-floris, 3 ad 4 mm longis.

A parasitic shrub, the branches up to 60 cm in length, terete, glabrous, dark colored when dry, with scattered minute lenticels, the branchlets densely ferruginous-puberulent. Leaves opposite, subopposite, and alternate, oblong, coriaceous, 6 to 8 cm long, 2 to 3.5 cm wide, obtuse, base obtuse to rounded, the upper surface glabrous, olivaceous, shining, the lower densely ferruginous-puberulent or tomentose; lateral nerves 4 to 6 on each side of the midrib, rather distinct on the upper surface, the reticulations very lax, on the lower surface obscure or even obsolete; petiole 4 to 10 mm long, densely ferruginous-puberulent. Flowers axillary, fascicled, 4-merous, curved, about 2.5 cm long, densely ferruginous-pubescent or tomentose, the peduncles 1- or 2-flowered, 3 to 4 mm long, when 2-flowered the pedicels about 1 mm in length. Calyx oblong-ovoid, about 3 mm long, truncate, densely ferruginous-tomentose, subtended by a small, ovate bract. Corolla in bud curved, about 2.2 cm long, in anthesis split down one side, externally densely ferruginous-tomentose, the tube about 1.6 cm long; lobes reflexed, about 6 mm long, somewhat spatulate. Anthers continuous with the filaments, about 2 mm long.

Kwangtung Province, Lin District, Lo Chi Chui, *Levine 3321,* October 14, 1918, on trees along the river.

This species belongs in the group with *Loranthus parasiticus* Merr. and is perhaps most closely allied to *Loranthus yadoriki*

Siebold. It may be the Kwangtung species recorded by Dunn & Tutcher as *Loranthus scurrula* Linn., but is certainly not the Linnean species.

ELYTRANTHE Blume

ELYTRANTHE FORDII (Hance) comb. nov.

Loranthus fordii Hance in Journ. Bot. 23 (1885) 38.

This species is apparently common in Kwangtung Province and is clearly an *Elytranthe*. It is represented by the following specimens: White Cloud hills, *Levine 2076;* Ting Woo Monastery, *Levine 2025;* Honam Island, *Levine 1006,* and North River, Tseng Uen, *Levine 2390.* The specimens have the following local names: *shui chi kei shaang, koh muk kei shang,* and *wo ko.*

VISCUM Linnaeus

VISCUM STIPITATUM Lecomte in Sargent Pl. Wils. 3 (1916) 319.

Kwangtung Province, Lin District, Leung Kong Ngon, *Levine 3465,* October 28, 1918.

Lecomte's species was based on material from Yunnan Province, and Levine's excellent specimen exactly matches the description. In leaf characters the species is distinctly similar to *Ginalloa.*

VISCUM ANGULATUM Heyne ex DC. Prodr. 4 (1830) 225; Hook. f. Fl. Brit. Ind. 5 (1886) 225.

Kwangtung Province, Poon Yue District, *Levine 3165,* November, 1918, with the local name *kei shang.*

This species has not previously been recorded from China. The specimen is in fruit but agrees closely with Indian material representing Heyne's species. India to Australia.

RANUNCULACEAE

RANUNCULUS Linnaeus

RANUNCULUS DIFFUSUS DC. Prodr. 1 (1824) 38.

Kwangtung Province, Shiuchow region, Tan Ha Shan, *To Kang P'eng 2901,* April, 1919, in grassy places.

India to China, Java, and Sumatra; not previously recorded from Kwangtung Province.

BERBERIDACEAE

NANDINA Thunberg

NANDINA DOMESTICA Thunb. Fl. Jap. (1784) 9.

Kwangtung Province, Shiuchow region, Fan Kwai No Shan, *To Kang P'eng 2778,* April 19, 1919, in forests.

Widely distributed in Japan and China, but not previously found so far south as Kwangtung Province.

MENISPERMACEAE

DIPLOCLISIA Miers

DIPLOCLISIA CHINENSIS sp. nov.

Frutex scandens, glaber; foliis late ovatis ad subreniformibus, 5 ad 10 cm longis, 7 ad 12 cm latis, apice acutis, basi 5-nerviis, late truncato-rotundatis ad leviter cordatis, petiolo 4 ad 7 cm longo; inflorescentiis axillaribus, pedunculatis, umbellato-cymosis, 1.5 ad 3 cm longis; floribus ♂ 6-meris, sepalis ellipticis ad obovatis, circiter 2.5 mm longis, lineolatis, petalis rhomboideis 1.5 mm longis, apice rotundatis, basi cuneatis, auriculis lateralibus acutis, inflexis.

Scandent, glabrous, the branches and branchlets usually reddish brown, terete. Leaves chartaceous, olivaceous on both surfaces or somewhat glaucous beneath, broadly ovate to subreniform, 5 to 10 cm long, 7 to 12 cm wide, entire or the margin obscurely undulate, apex acute, base broadly truncate-rounded to shallowly cordate, 5-nerved; petioles 4 to 7 cm long. Inflorescences axillary, solitary, umbellate-cymose, the peduncles 1 to 2 cm long, the flower-bearing portion less than 1 cm in diameter, the pedicels 2 to 4 mm long, lineolate. Petals 6, rhomboid, 1.5 mm long, apex rounded, base acute, the auricles lateral, acute, inflexed; filaments 2 mm long.

Kwangtung Province, Shiuchow region, Fan Kwai No Shan, *To Kang P'eng 2764* (type), *2779 p. p.*, April 19, 1919.

This species is closely allied to *Diploclisia affinis* (Oliv.) Diels but differs in its larger leaves which are broadly ovate to subreniform, their bases truncate-rounded to shallowly cordate and not at all peltate. My specimen of *No. 2779* cited above consists in part of this species and in part of *Pericampylus glaucus* (Lam.) Merr.

LAURACEAE

LITSEA Lamarck

LITSEA CUBEBA (Lour.) Pers. Syn. 2 (1807) 4.

Laurus cubeba Lour. Fl. Cochinch. (1790) 252.
Litsea piperita Juss. in Ann. Mus. Paris 6 (1805) 213.
Persea cubeba Spreng. Syst. 2 (1825) 269.
Daphnidium cubeba Nees Syst. Lour. (1836) 615.
Tetranthera cubeba Meisn. in DC. Prodr. 15 [1] (1864) 199.
Litsea citrata Blume Bijdr. (1825) 595; Lecomte Fl. Gén. Indo-Chine 5 (1914) 138; Gamble in Journ. As. Soc. Beng. 75 [1] (1912) 146.
Tetranthera citrata Nees Syst. Lour. (1836) 560.
Tetranthera polyantha Wall. Cat. (1830) No. 2538, *nomen nudum*, Nees in Wall. Pl. As. Rar. 2 (1831) 67, Syst. Lour. (1836) 545.
Tetranthera floribunda Champ. in Hook. Kew Journ. Bot. 5 (1853) 199

Loureiro's material was from Cochin China, but his species and the numerous synonyms based upon it have never been satisfactorily placed and it is not mentioned by Lecomte in his recent treatment of the Lauraceae of Indo China.[6] Hemsley[7] states that he had seen only the fruit as it appears in commerce. It is evident from Loureiro's other descriptions of species of *Laurus* that the statement that the leaves of *Laurus cubeba* were nerveless was intended by him to imply that there were no longitudinal nerves as in *Cinnamomum,* for he placed all the species of *Cinnamomum* known to him under *Laurus.* The fruits are black, about the size, shape, and color of the fruits of black pepper, as Loureiro notes, and like the leaves are very aromatic. The species extends from Central China to India southward to Java, and it is manifest that Loureiro's specific name should be adopted for the species currently known as *Litsea citrata* Blume. I have examined the following material:

China, Kwangtung Province, *Merrill 10960, Levine & Groff 158, Levine 1398, 3063, 3248,* with the local name *tan shi keung, To Kang P'eng 2658,* with the local name *ts'ing tsz muk:* India, *Meebold 5532, Craib 255:* Indo China, *Bon 4278:* Malay Peninsula, Perak, *Scortechini 270b, Haniff & McNur 2323:* Java, *Koorders 3173, 25602, 27798, 32911, 38125, Winckel 256.*

MACHILUS Nees

MACHILUS LEVINEI sp. nov.

Arbor parva, glaberrima; foliis oblongis, crasse coriaceis, usque ad 18 cm longis, acuminatis, subtus glaucescentibus, nervis utrinque 15 ad 18, subtus distinctis; inflorescentiis terminalibus, ramis umbellato-fasciculatis, 2 ad 3.5 cm longis; perianthii segmentis anguste oblongis, coriaceis, glabris, circiter 10 mm longis.

A small, entirely glabrous tree, the branches and branchlets reddish brown, wrinkled when dry, not lenticellate. Leaves thickly coriaceous, oblong, 12 to 18 cm long, 3 to 4.5 cm wide, base obtuse to acute, apex shortly acuminate, the upper surface smooth, shining, rather pale when dry, the lower glaucous, the midrib impressed on the upper surface, very prominent and reddish brown on the lower; lateral nerves 15 to 18 on each side of the midrib, slender, distinct beneath, curved-ascending at an angle of about 45 degrees; petioles reddish brown, about 2.5 cm long. Inflorescences terminal, the primary branches about 8, reddish brown, umbellate-fascicled, 2 to 3.5 cm long, few-flowered. Perianth segments oblong or narrowly oblong, acute to obtuse,

[6] Fl. Gén. Indo-Chine 5 (1914) 107–158.
[7] Journ. Linn. Soc. Bot. 26 (1891) 380.

coriaceous, about 10 mm long and 3 mm wide, glabrous. Ovary glabrous. Immature fruit globose.

Kwangtung Province, Teng Woo Mountain, *Levine 2024*, May 26, 1918, scattered on slopes, altitude about 300 meters.

This species is well characterized by its oblong, thickly coriaceous, rather numerously nerved leaves which are glaucous beneath, and by its long, coriaceous, glabrous perianth segments. It is apparently as closely allied to *Machilus phoenicis* Dunn as to any other species, which, however, has smaller, differently shaped, fewer-nerved leaves and much shorter petioles.

LINDERA Thunberg

LINDERA SUBCAUDATA (Merr.) comb. nov.

Neolitsea subcaudata Merr. in Philip. Journ. Sci. 13 (1918) Bot. 137.

Additional material with staminate flowers representing this species shows it to be a *Lindera,* allied to *L. strychnifolia* (Meisn.) F.-Vill. It is now represented by *Merrill 11016, Levine 1351, Groff 2463, To Kang P'eng 2707,* the latter with staminate flowers bearing the local name *heung kau shü.*

SAXIFRAGACEAE

ANDROSACE Linnaeus

ANDROSACE UMBELLATA (Lour.) comb. nov.

Drosera umbellata Lour. Fl. Cochinch. (1790) 186.

Androsace saxifragifolia Bunge in Mém. Acad. St. Pétersb. 2 (1836) 127; Pax & Knuth in Engl. Pflanzenreich 22 (1905) 179.

Loureiro cites both Chinese and Cochinchinese names for this species, although he also states "Habitat in China." It would seem that he observed the species in both regions. The species extends from India to Japan southward to Indo-China and northern Luzon and occurs at low altitudes both in Kwangtung Province, China, and in Indo China. The species is clearly no *Drosera,* but among all the species of plants known from southern China, Loureiro's description applies only to *Androsace saxifragifolia* Bunge. There is, hence, no reason why Loureiro's specific name should not be adopted for this well-known species. Planchon [8] has already indicated that Loureiro's species might be an *Androsace.*

ROSACEAE

PYGEUM Gaertner

PYGEUM TOPENGII sp. nov. § *Sericophyllum.*

Arbor circiter 12 m alta, ramis glabris, ramulis ferrugineo-pubescentibus; foliis coriaceis, elliptico-ovatis, usque ad 9 cm

[8] Ann. Sci. Nat. III 9 (1848) 304.

longis, breviter obtuse acuminatis, basi plerumque acutis, leviter inaequilateralibus, haud vel obscurissime glandulosis, supra in siccitate pallidis, nitidis, glabris, subtus ad costa nervisque leviter ciliatis, nervis utrinque 6 vel 7, subtus perspicuis; infructescentiis axillaribus, solitariis, depauperato-paniculatis, 4 ad 5 cm longis; fructibus subreniformibus, glabris, minute apiculatis, circiter 8 mm longis, 10 ad 12 mm latis; seminibus solitariis, testa extus sericeis.

A tree about 12 m high, the branches dark reddish brown, lenticellate, glabrous, the branchlets ferruginous-pubescent as are the petioles and apparently the inflorescences. Leaves coriaceous, elliptic-ovate, 6 to 9 cm long, 3 to 5 cm wide, shortly and rather bluntly acuminate, base acute, usually somewhat inequilateral, eglandular or the glands obscure and not at all projecting, the upper surface, except in very young leaves, glabrous, pale and shining when dry, the lower somewhat ciliate on the midrib and nerves; lateral nerves 6 or 7 on each side of the midrib, prominent; petioles 5 to 7 mm long; stipules oblong, pubescent, deciduous, about 5 mm long. Infructescences axillary, solitary, from the branchlets below the leaves, 4 to 5 cm long, sparingly pubescent, usually with a single basal branch 1 to 2 cm in length. Fruits subreniform, brown when dry, slightly apiculate, glabrous, about 8 mm long, 10 to 12 mm wide, their pedicels 3 mm long or less. Seeds solitary, the testa distinctly silky-villous.

Kwangtung Province, Kochow region, Shek Kau Tong, *To Kang P'eng 2750*, March 5, 1919.

Pygeum henryi Dunn is the only species of the genus definitely known from China, but the present one is entirely different. *Pygeum latifolium* Miq. is recorded from Hongkong by Hemsley but Miquel's species is definitely known only from Java, having long been confused with a Philippine species. It is possible that the present species is identical with the Chinese form previously referred to *Pygeum latifolium* Miq., but it is safely not Miquel's species.

SANGUISORBA Ruppius

SANGUISORBA OFFICINALIS Linn. Sp. Pl. (1753) 116.

Kwangtung Province, Lin District, Shan Mo Ling and Sing Tize Foo, *Levine 3181, 3191*, September 15, 1918, with the local name *mar lin on*.

The genus is new to Kwangtung Province. There seems to be some difference of opinion among botanists as to the distribution of Chinese forms of this genus between *Sanguisorba offi-*

cinalis Linn. and *S. canadensis* Linn., the present material matching specimens from various parts of China, some identified as *S. officinalis* Linn. and some as *S. canadensis* Linn. The Kwangtung material closely matches European material of *S. officinalis* Linn., and I assume this name to be correct for it. *Sanguisorba formosana* Hayata, as represented by Formosan material, *Kawakami 93*, is scarcely to be distinguished.

POTENTILLA Linnaeus

POTENTILLA DISCOLOR Bunge Enum. Pl. Chin. Bor. (1831) 25.

Kwangtung Province, Shiuchow region, *To Kang P'eng 2775*, April 19, 1919.

Widely distributed in northern and central China, extending to Formosa (a variety); not previously recorded from Kwangtung Province.

LEGUMINOSAE

PITHECOLOBIUM Martius

PITHECOLOBIUM TURGIDUM sp. nov.

Arbor parva, partibus junioribus ferrugineo-pubescentibus; foliis bipinnatis, pinnis 1-jugis, foliolis amplis, bijugis, membranaceis vel chartaceis, glabris, nitidis, acuminatis, majoribus usque ad 15 cm longis, oblongo-ovatis, basi acutis, nervis utrinque 6 ad 8, perspicuis; leguminis turgidis, rectis, dehiscentibus, oblongis, 7 ad 9 cm longis circiter 3 cm latis, et 1 ad 1.5 cm crassis, valvis coriaceis; seminibus ellipsoideis, 1.8 ad 2.5 cm longis, haud compressis.

A small tree, 3 to 4 m high *fide* Levine, glabrous except the younger parts which are ferruginous- or castaneous-pubescent. Leaves bipinnate, pinnae 1-jugate, leaflets bijugate, the petiole 2 to 6 cm long, with a single large gland at the apex below the insertion of the single pair of terminal pinnae, the rachises of the pinnae 5 to 8 cm long, each bearing four large leaflets and usually with a terminal gland; leaflets membranaceous to chartaceous, oblong-ovate to elliptic-ovate, pale greenish and shining when dry, glabrous, base acute, equilateral, the apex acuminate, 9 to 15 cm long, 4 to 7 cm wide, the lateral nerves 6 to 8 on each side of the midrib prominent. Panicles pyramidal, in bud up to 14 cm long, the flowers in globose heads at the tips of the branchlets, pubescent. Pods oblong, turgid, dehiscent, 7 to 9 cm long, about 3 cm wide, 1 to 1.5 cm thick, each usually with about four seeds, the sutures not thickened, the valves coriaceous, continuous, brown, smooth. Seeds contiguous, ellipsoid,

not compressed, brown, smooth, shining, 1.8 to 2.5 cm long, persistent for a considerable period after the pod dehisces by the elongated, slender, more or less curved funiculus, the latter about 1 cm in length.

Kwangtung Province, Teng Woo Mountain, *Levine & Groff 86,* November 18, 1916, with mature fruits, *Levine 1976,* April 26, 1918, from the same tree, with immature buds and fully mature seeds; along streams, altitude about 300 meters.

This species, distributed as an *Albizzia,* like its congener, *Pithecolobium balansae* Oliv., and apparently *P. attopenense* Pierre (of which the fruits are unknown), is anomalous in *Pithecolobium* in its straight, turgid, not at all twisted or curved pods, and is equally anomalous in *Albizzia.* It is suspected that it may prove to represent a distinct generic type.

PAHUDIA Miquel

PAHUDIA XYLOCARPA Kurz Forest Fl. Brit. Burma 1 (1877) 413.

Kwangtung Province, Kochow region, Sai Ngon, *To Kang P'eng 2705,* February 18, 1919, a single tree, said to have been grown from seeds secured in Burma. It is locally known as *min ke.*

The specimen, which presents a mature pod and seeds, agrees closely with Kurz's description, the species having been based on material originating near the Burmese border of Siam.

CASSIA Linnaeus

CASSIA FISTULA Linn. Sp. Pl. (1753) 377.

Kwangtung Province, Tak Hing, *Levine 3587,* April, 1919, from an introduced and cultivated tree. A native of tropical Asia, pantropic in cultivation.

ORMOSIA Jackson

ORMOSIA HAINANENSIS Gagnep. in Not. Syst. 3 (1914) 31.

Hainan, *Hongkong herbarium 443! Miss Moninger 122!,* in fruit: Kwangtung Province, Kochow region, Shek Kau T'ong, *To Kang P'eng 2664,* March 3, 1919, in forests.

The pods, description from Miss Moninger's Hainan specimen, contain from 1 to 4 seeds, and when more than 1-seeded are somewhat torulose. They are 2 to 4 cm long and 1 to 1.5 cm wide, much thickened, glabrous, brown when dry, the valves thickened, somewhat woody, irregularly twisted after dehiscence. Seeds red, dangling from the pod after dehiscence, not arillate, 15 to 18 mm long. When but 1-seeded the pods are usually con-

spicuously stipitate, but the pseudostalk presents several undeveloped ovules. The species seems to be allied to *Ormosia fordiana* Oliv.[9]

PTEROLOBIUM R. Brown

PTEROLOBIUM ROSTHORNII Harms in Engl. Bot. Jahrb. 29 (1900) 410.

Kwangtung Province, Lin District, Pak hill, *Levine 3208*, October 21, 1918, with the local name *ye tau*.

This is the second species of the genus to be found in Kwangtung Province. The material agrees very closely with the original description, which, however, is rather short and imperfect. It has not otherwise been reported except by the original collections in southern Szechuen. The Kwangtung material is in fruit, the wings being 1.2 to 1.5 cm wide, brown and shining when dry, and apiculate-acuminate by the nearly straight upper suture which is slightly produced at the tip.

DERRIS Loureiro

DERRIS ELEGANS (Grah.) Benth. in Miq. Pl. Jungh. (1852) 252, Journ. Linn. Soc. Bot. 4 (1860) Suppl. 109; Baker in Hook. f. Fl. Brit. Ind. 2 (1878) 252.

Pongamia elegans Grah. in Wall. Cat. (1832) No. 7540, *nomen nudum*.

Kwangtung Province, Shai Chiu Mountain, *Levine 2074*, May 4, 1918, with the local name *kau ngar fa*.

This species has not previously been reported from China, but the flowering specimen cited above is an excellent match for our large series of Philippine specimens representing it; fruiting specimens of the Chinese form are desirable to verify the correctness of the determination.

Tenasserim, Andaman Islands, Malay Peninsula, Sumatra, and the Philippines.

DERRIS TRIFOLIATA Lour. Fl. Cochinch. (1790) 433.

The genus *Derris* was based by Loureiro on two species. The first, *D. pinnata*, the type of which is preserved in the herbarium of the British Museum, is *Dalbergia pinnata* (Lour.) Prain, a species of wide distribution in the Indo-Malayan region more commonly known as *Dalbergia tamarindifolia* Roxb. The second species described by Loureiro, *D. trifoliata*, was based on specimens from the vicinity of Canton, and the type is preserved in the herbarium of the Paris Museum of Natural History. I am of the opinion that this species should be interpreted as the type of the genus *Derris*. The species by many authors has been reduced to *Derris uliginosa* (Roxb.) Benth., and a recent critical

[9] In Hook. Ic. IV 5 (1895) *t. 2422*.

examination of the type by Doctor Gagnepain shows that it is identical with Roxburgh's species. Prain [10] thought that Loureiro's description did not apply sufficiently closely to *Derris uliginosa* to warrant reducing Loureiro's species to the latter. The examination of the type by Doctor Gagnepain, however, definitely settles this matter; and Loureiro's name, being the older, should be retained for this very common, characteristic, and widely distributed species. It occurs typically along the margins of tidal streams more or less subject to the influence of brackish or salt water, from tropical East Africa through India to southern China and Formosa, southward through Malaya to tropical Australia and Polynesia.

DUNBARIA Wight and Arnott

DUNBARIA ROTUNDIFOLIA (Lour.) comb. nov.

Indigofera rotundifolia Lour. Fl. Cochinch. (1790) 458.
Dolichos conspersus Grah. in Wall. Cat. (1831–32) No. 3342, *nomen nudum.*
Dunbaria conspersa Benth. in Miq. Pl. Jungh. (1852) 242.
Dunbaria punctata Benth. l. c.
Dolichos punctatus Wight & Arn. Prodr. (1834) 237.

Loureiro's type was from the vicinity of Canton, and his description applies closely to the species currently known as *Dunbaria conspersa* Benth. except that the pods have more than two seeds. No other leguminous species known from Kwangtung agrees at all with Loureiro's description. I have examined the following Kwangtung specimens: *Merrill 10146, Levine 1111, 3345.* Loureiro records the Cantonese name as *o tam sin;* that recorded on one of Levine's specimens is *chin tang,* not very different from Loureiro's name if the words be reversed.

MUCUNA Adanson

MUCUNA COCHINCHINENSIS (Lour.) A. Chev. in Bull. Agr. Inst. Sci. Saigon 1 (1919) 91.

Marcanthus cochinchinensis Lour. Fl. Cochinch. (1790) 461.
Carpopogon niveum Roxb. Fl. Ind. ed. 2, 3 (1832) 385.
Mucuna nivea Wight & Arn. Prodr. (1834) 255.
Stizolobium niveum O. Kuntze Rev. Gen. Pl. (1891) 207.

Kwangtung Province, Lin District, *Levine 3283,* with the local name *kau chau tau t'ang.*

Loureiro's material was from Cochin China, undoubtedly from the vicinity of Hue where he resided most of the time while

[10] Journ. As. Soc. Beng. 66 [2] (1898) 458.

in Cochin China. His description applies unmistakably to the widely distributed and cultivated species currently known as *Mucuna nivea* Wight & Arn., and his specific name will replace that based on Roxburgh's binomial. Loureiro's description of the pods was apparently based on fresh rather than on dried material. Loureiro resided at Hue, and a mature pod secured from this locality under the local name cited by Loureiro, submitted to me by Dr. A. Chevalier, is identical with *Mucuna nivea* Wight & Arn. Prof. C. V. Piper informs me that he examined Loureiro's type in the herbarium of the British Museum in 1912, a leaf specimen only, making the note at that time that it might be any of the species allied to *Mucuna nivea,* but that it probably represented the latter species.

POLYGALACEAE

POLYGALA Linnaeus

POLYGALA TENUIFOLIA Willd. Sp. Pl. 3 (1800) 879.

Kwangtung Province, Shiuchow region, *To Kang P'eng 2809, 2770, 2903,* in thickets and forests.

In China previously recorded from Chihli, Shingking, and Shantung, but not previously reported from southern China. The specimens cited above agree closely with material from Chihli, differing chiefly in some of the leaves being broader than in the northern form.

EUPHORBIACEAE

EUPHORBIA Linnaeus

EUPHORBIA ESULA Linn. Sp. Pl. (1753) 461; Boiss. in DC. Prodr. 15 [2] (1862) 160; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26 (1894) 412.

Kwangtung Province, North River, Fu Ok, *Groff 2279,* March, 1918.

Widely distributed in Asia, but not previously reported from southern China.

EXCOECARIA Linnaeus

EXCOECARIA COCHINCHINENSIS Lour. Fl. Cochinch. (1790) 612; Muell.-Arg. in DC. Prodr. 15 [2] (1866) 1215.

Kwangtung Province, cultivated at the Canton Christian College, *Groff 2963.* This is the typical form with red leaves, cultivated for ornamental purposes; namely, typical *Excoecaria bicolor* Hassk.

EXCOECARIA COCHINCHINENSIS Lour. Fl. Cochinch. (1790) 612, var. VIRIDIS (Pax & K. Hoffm.).

Excoecaria bicolor Hassk. Retzia 1 (1855) 158, var. *viridis* Pax & K. Hoffm. in Engl. Pflanzenreich 52 (1912) 159.

Kwangtung Province, Kochow region, Kwong T'am, *To Kang P'eng, 2672*, March 22, 1919.

I believe the cultivated form with colored leaves described by Loureiro as *Excoecaria cochinchinensis* to be identical with *Excoecaria bicolor* Hassk., which being the case Loureiro's name should be retained. The type of *Excoecaria bicolor* Hassk. var. *viridis* Pax & K. Hoffm. was from Cochin China, and the description agrees entirely with the specimen cited above. The species is new to China.

ALCHORNEA Swartz

ALCHORNEA RUGOSA (Lour.) Muell.-Arg. in Linnaea 34 (1865) 170.

Alchornea hainanensis Pax & K. Hoffm. in Engl. Pflanzenreich 63 (1914) 242 !

Cladodes rugosa Lour. Fl. Cochinch. (1790) 574.

Kwangtung Province, Kochow region, Kwanshan temple, *To Kang P'eng 2662*, March 18, 1919.

This is the first record of the species from China proper, although it had previously been recorded from Hainan Island. Unless *Alchornea rugosa* (Lour.) Muell.-Arg. is variable in the number of its stamens, it would seem that Pax and Hoffmann are wrong in their interpretation of *Alchornea rugosa*, and that they described as a new species the typical form as described by Loureiro under *Cladodes rugosa*. Loureiro describes his species as having eight stamens, the only character depended upon by Pax and Hoffmann in separating the Hainan form from *Alchornea rugosa*. In *Alchornea hainanensis* the staminate flowers have eight stamens, as does the Kwangtung specimen cited above, thus agreeing with Loureiro's original description of *Cladodes rugosa*. J. J. Smith states that in all staminate flowers of the Javan form referred by him to *Alchornea rugosa* the number of stamens was four; Pax and Hoffmann state stamens 4, rarely 5 or 6. The actual specimens so closely resemble each other that I strongly suspect that the species has a variable number of stamens, 4 to 8. Should this not prove to be the case, then Loureiro's specific name will have to be retained for the form characterized by Pax and Hoffmann as *Alchornea hainanensis*, while for the common Malayan form the name *Alchornea javanensis* (Blume) Muell.-Arg. will have

to be revived, or the still earlier one, *Croton apetalum* Blume, transferred to *Alchornea*. It is to be noted that Pax and Hoffmann saw no Cochin China material representing Loureiro's species.

ANACARDIACEAE

POUPARTIA Commerson

POUPARTIA CHINENSIS sp. nov.

Arbor circiter 8 m alta, inflorescentiis exceptis glabra; foliis 20 ad 30 cm longis, foliolis 11 ad 15, membranaceis ad chartaceis, oblongo-lanceolatis, 6 ad 9 cm longis, acuminatis, leviter inaequilateralibus, glabris vel junioribus subtus in axillis leviter barbatis, nervis utrinque 9 ad 12; petiolulis circiter 2 mm longis; inflorescentiis terminalis, amplis, circiter 30 cm longis, ramis inferioribus usque ad 15 cm longis, cinereo-pubescentibus; floribus ♂ 5-meris, calyces circiter 1.5 mm diametro; petalis oblongis, 2.5 mm longis, reflexis; staminibus 10, filamentis 2 ad 2.3 mm longis; ovario glabro, 4- ad 5-locellato.

A tree about 8 m high, the inflorescences more or less cinereous-pubescent. Ultimate branches about 5 mm in diameter, smooth, glabrous, terete. Leaves 20 to 30 cm long, the rachis sparingly pubescent; leaflets 11 to 15, membranaceous to chartaceous, oblong-lanceolate, 6 to 9 cm long, 1.5 to 2.5 cm wide, somewhat inequilateral at the base, apex acuminate, glabrous, or the younger ones sparingly bearded in the axils on the lower surface; lateral nerves 9 to 12 on each side of the midrib, slender; petiolules about 2 mm long. Inflorescence a terminal leafy panicle about 30 cm in length, the lower branches up to 15 cm long, subtended by normal but usually reduced leaves, the upper 15 to 20 cm of the panicle leafless; the branches, branchlets, and pedicels cinereous-pubescent. Flowers numerous, white, pistillate and staminate ones in the same inflorescences. Calyx of the staminate flowers about 1.5 mm in diameter, the lobes 5, ovate, acute or obtuse, about 0.5 mm long. Petals oblong, 2.5 mm long, their margins somewhat inflexed, reflexed in anthesis, nerveless. Stamens 10, their filaments filiform, 2 to 2.3 mm long. Pistillate flowers similar to the staminate ones. Ovary glabrous, 4- or 5-celled; styles 4 or 5, about 1 mm long.

Kwangtung Province, Honam Island, on the campus of Canton Christian College, *Levine 3521*, May 13, 1919.

This is the second species of the genus to be found in China, differing radically from *Poupartia fordii* Hemsl. in its very much larger, terminal, distinctly pubescent inflorescences, the

staminate and pistillate flowers borne in the same inflorescences; much smaller pistillate flowers; much more numerous leaflets; and shorter petiolules.

CELASTRACEAE

CELASTRUS Linnaeus

CELASTRUS HOOKERI Prain in Journ. As. Soc. Beng. 72 [2] (1904) 197; Rehd. & Wils. in Sargent Pl. Wils. 2 (1915) 352.

Kwangtung Province, North River and Shiuchow regions, *Groff 2300, 2294, To Kang P'eng 2875.*

India; previously recorded from China from Yunnan, Szech'uan, and Fokien, but not before reported from Kwangtung Province.

SAPINDACEAE

KOELREUTERIA Lakman

KOELREUTERIA BIPINNATA Franch. in Bull. Soc. Bot. France 33 (1886) 463, Pl. Delavay. (1889) 143, *t. 29, 30.*

Kwangtung Province, Ying Tak District, *Levine 3484,* December 9, 1918.

This species is new to Kwangtung Province and this record represents a considerable southward extension of range for it. The specimen is in fruit and agrees closely with our rather full series of specimens from Yunnan Province.

ELAEOCARPACEAE

ELAEOCARPUS Linnaeus

ELAEOCARPUS DUBIUS A. DC. in Bull. Herb. Boiss. II 2 (1903) 366; Gagnep. in Lecomte Fl. Gén. Indo-Chine 1 (1910) 572.

Kwangtung Province, Kochow region, Shek Kau Tong, *To Kang P'eng 2686,* March 5, 1919, in forests.

The specimen agrees in all respects with the descriptions of this species and with *Bon 4298!, 2671!* from Tonkin. Previously known only from Tonkin.

MALVACEAE

HIBISCUS Linnaeus

HIBISCUS SURATTENSIS Linn. Sp. Pl. (1753) 696.

Kwangtung Province, Kochow region, Fat Tsz Ling, *To Kang P'eng 2730,* February, 1919, along roadsides.

This widely distributed Indo-Malayan species has been recorded from Hainan, but I can find no record for it from China proper.

THEACEAE

EURYA Thunberg

EURYA GROFFII sp. nov.

Frutex vel arbor parva; ramis teretibus, glabris, ramulis pilosis; foliis lanceolatis, chartaceis vel subcoriaceis, usque ad 6 cm longis et 1.2 cm latis, nitidis, supra glabris, subtus pilosis, apice tenuiter acuminatis, basi obtusis, plerumque leviter inaequilateralibus, costa supra impressa, subtus cum venis prominulis; fructibus axillaribus, fasciculatis, globosis vel ovoideis, glabris, stylis connatis; sepalis elliptico-ovatis, exterioribus leviter pilosis, coriaceis, 1.5 ad 2 mm longis.

A shrub or a small tree, the branchlets rather densely pilose. Branches terete, glabrous, dark reddish brown. Leaves numerous, lanceolate, chartaceous to subcoriaceous, greenish olivaceous and shining when dry, 3.5 to 6 cm long, 8 to 12 mm wide, the margins denticulate, the upper surface glabrous, the lower pilose, the midrib above impressed, prominent beneath, the lateral nerves obsolete or subobsolete on the upper surface, distinct and somewhat projecting on the lower surface, the apex slenderly acuminate, the base obtuse and often minutely inequilaterally cordate, sessile or subsessile. Fruits axillary, glabrous, globose or ovoid, 3 to 3.5 mm in diameter, smooth, their pedicels 1 to 1.5 mm long; styles united for the lower 1 mm, the arms about 1 mm long. Sepals coriaceous, elliptic-ovate, 1.5 to 2 mm long, rounded, the outer ones somewhat pilose.

Kwangtung Province, Tiu Kaan Shan, Tseng Uen, *Groff 2378*, March, 1918, on mountain sides.

In vegetative characters and general appearance this species strongly resembles *Eurya swinglei* Merr., but differs radically in its entirely glabrous fruits and much shorter styles. From *Eurya distichophylla* Hemsl. it is readily distinguished by its slenderly acuminate leaves and the veins obsolete or nearly so on the upper surface and projecting on the lower surface. The fruits and staminate flowers of Hemsley's species are as yet unknown.

FLACOURTIACEAE

XYLOSMA Forster f.

XYLOSMA CONGESTUM (Lour.) comb. nov.

Croton congestum Lour. Fl. Cochinch. (1790) 582, excl. descr. fruct.
Xylosma racemosum Miq. Ann. Mus. Bot. Lugd.-Bat. 2 (1865–66) 155.
Hisingera racemosa Sieb. & Zucc. Fl. Jap. Fam. Nat. 1 (1843) 169.
Xylosma japonicum A. Gray in Mem. Amer. Acad. II 6 [1] (1863) 381.
Flacourtia chinensis Clos. in Ann. Sci. Nat. Bot. IV 8 (1857) 219.

This species is very common in thickets in the vicinity of Canton, Loureiro's type having been from Canton. J. Mueller [11] notes that Loureiro's description of the flowers and of the inflorescences does not conform to *Croton;* further it does not conform with the characters of any euphorbiaceous plant known from Kwangtung Province, but, with the exception of the fruit description, agrees entirely with the species currently known as *Xylosma racemosum* Miq. It is clear that Loureiro either added the fruit description to make his species agree with the generic characters of *Croton,* or described the fruits from material originating from a species entirely unrelated to the flowering specimen described by him. I have examined the following specimens from Kwangtung Province, mostly from the immediate vicinity of Canton: *Merrill 9850, 9993, Groff 2252, 2353, Levine 18, 171, 172, 177, 279, 365, 366, 371, 1749, 1809, 1829, 2084, 3261, 3341, To Kang P'eng 2727, 2737.* The local names recorded are *wu ying shue* (vicinity of Canton), *ch'ui tung ts'ai* (North River region), and *chü nga lak shü* (Kochow region). The name *pa tau* recorded by Loureiro should probably be excluded as it is the same as the name recorded by him for *Croton tiglium* Linn.

THYMELAEACEAE

AQUILARIA Lamarck

AQUILARIA SINENSIS (Lour.) comb. nov.

Ophiospermum sinense Lour. Fl. Cochinch. (1790) 281.
Aquilaria chinensis Spreng. Syst. 2 (1825) 356.
Aquilaria grandiflora Benth. Fl. Hongk. (1861) 297.

Loureiro cites no definite locality, but from the fact that he indicated the local name *pa mou yong* as Chinese it is clear that his material was from China, and in all probability from the vicinity of Canton. The description definitely applies to the species commonly known as *Aquilaria grandiflora* Benth., one that is not uncommon in the vicinity of Canton. Loureiro's description of the perianth as 6-merous was apparently due to an error on his part, for he enumerates the stamens as five, thus indicating that he was describing a 5-merous flower. I have examined the following Kwangtung material: *Groff 2487, Merrill 10962, Levine 996, 1400, 2070,* from Tsangsheng, Wa Shau Toi, White Cloud Mountain, and Honam Island, the last two localities being in the immediate vicinity of Canton. Loureiro's

[11] DC. Prodr. 15 [2] (1866) 696.

type is preserved in the herbarium of the Paris Museum and is identical with the species as here interpreted.

RHIZOPHORACEAE

CARALLIA Roxburgh

CARALLIA BRACHIATA (Lour.) comb. nov.

Diatoma brachiata Lour. Fl. Cochinch. (1790) 296.
Carallia lucida Roxb. Hort. Beng. (1814) 92, *nomen nudum*, Pl. Coromandel 3 (1819) 8, *t. 211*.
Carallia integerrima DC. Prodr. 3 (1828) 33.
Petalotoma brachiata DC. op. cit. 295.

Kwangtung Province, White Cloud Mountain, near Canton, *Levine 3386*, local name *nik nga tsai;* Poon Yue District, *Levine 3138;* Kochow region, *To Kang P'eng 2676, 2751*, with the local name *ngo shen muk*.

Loureiro's generic name has priority over *Carallia*, but the latter is retained in the list of *nomina conservanda* adopted by the Vienna Botanical Congress. *Petalotoma* DC. is merely a new generic name for *Diatoma*. I believe Loureiro's description applies to the common and widely distributed Indo-Malayan species commonly known as *Carallia lucida* Roxb. and as *C. integerrima* DC., the last two certainly being conspecific.

MYRTACEAE

EUGENIA Linnaeus

EUGENIA BULLOCKII Hance in Journ. Bot. 16 (1878) 227.

Kwangtung Province, Kochow region, Shek Tan Kong, *To Kang P'eng 2995*, March, 1919.

This specimen, although in fruit, agrees closely with the original description and with Hainan material collected by Miss Moninger, which I have identified with Hance's species. It was previously known only from Hainan.

ARALIACEAE

ARALIA Linnaeus

ARALIA SPINIFOLIA sp. nov. § *Arborescentes*.

Frutex erectus, circiter 3 m altus, foliis inflorescentiisque perspicue spinosis atque setosis; foliis magnis, bipinnatis, pinnis circiter 30 cm longis, 5- ad 9-foliolatis; foliolis oblongo-ovatis, usque ad 12 cm longis, membranaceis, acuminatis, brevissime petiolulatis, basi rotundatis, serratis, utrinque ad costa nervisque parce spinosis atque setosis; inflorescentiis magnis, laxis,

umbellulis longe pedunculatis; fructibus ovoideis, 5 mm longis, glabris, 5-carinatis, perspicue 5-sulcatis, pedicellis 1 ad 1.5 cm longis.

An erect shrub about 3 m high. Leaves large, bipinnate, the rachis, partial rachises, and leaflets on both surfaces with scattered, long, slender, nearly straight spines and with more numerous, slender, spreading setae, the spines 3 to 10 mm long, the setae 1.5 to 3 mm in length. Pinnae 5- to 9-foliolate, about 30 cm long; leaflets oblong-ovate, membranaceous, dark brown or olivaceous when dry, the lower surface somewhat paler than the upper, 9 to 12 cm long, 4 to 6 cm wide, subsessile, base rounded, often slightly inequilateral, apex acuminate, margins serrate, the teeth apiculate, the spines few, scattered, and mostly confined to the midrib with a few on the primary nerves, fewer on the lower surface than on the upper, the setae more numerous and scattered all over the epidermis on both surfaces. Inflorescences ample, lax, the ultimate branchlets up to 10 cm in length. Umbels subglobose, about 30 fruits in each, the pedicels 10 to 15 mm long, setose. Fruits ovoid, glabrous, about 5 mm long, prominently 5-keeled and deeply 5-sulcate, the depressions broad, rounded.

Kwangtung Province, Chan Tung hill, *Levine 3242,* October 30, 1918, with the local name *lak cha tsui.*

This species is readily distinguished among its congeners by its spiny and setose rachises, partial rachises, leaflets, and inflorescences.

PRIMULACEAE

LYSIMACHIA Tournefort

LYSIMACHIA CANDIDA Lindl. var. **DEPAUPERATA** var. nov.

A typo differt planta multo minoribus 5 ad 8 cm altus, foliis oblanceolatis ad obovatis, 5 ad 15 cm latis, obtusis vel subacutis, pedicellis quam floribus haud longioribus.

Kwangtung Province, Kochow region, Fung Mun, *To Kang P'eng 2735,* February 22, 1919, in fields.

LYSIMACHIA ALFREDI Hance in Journ. Bot. 15 (1877) 356; Pax & Knuth in Engl. Pflanzenreich 22 (1905) 281.

Kwangtung Province, Shiuchow region, *To Kang P'eng 2858, Levine 3524,* April, 1919, in woods.

The identification has been made from the descriptions, the former number cited agreeing better with it than the latter, although differing in some details. The species has previously been known only from Fokien Province.

EBENACEAE

DIOSPYROS Linnaeus

DIOSPYROS SINENSIS Hemsl. in Journ. Linn. Soc. Bot. 26 (1889) 71.

Kwangtung Province, Shiuchow region, *To Kang P'eng 2785, 2788.*

Previously known from Szechuen and Hupeh Provinces, but not before reported from as far south as Kwangtung.

SYMPLOCACEAE

SYMPLOCOS Jacquin

SYMPLOCOS FUSONII sp. nov. § *Hopea, Lodhra.*

Frutex 2 ad 3 m altus, ramulis castaneo- vel purpureo-pubescentibus, inflorescentiis cinereo-pubescentibus. Foliis coriaceis vel subcoriaceis, glabris, ellipticis ad oblongo-ellipticis, usque ad 5.5 cm longis, nitidis, margine minute glanduloso-serrulatis vel crenulatis, deorsum integris, apice acutis vel brevissime acuminatis, basi acutis, nervis utrinque 5 vel 6, anastomosantibus, costa supra haud impressa; racemis axillaribus, solitariis vel binis, paucifloris, 8 ad 10 mm longis, floribus omnibus pedicellatis; fructibus oblongo-ovoideis, leviter adpresse pubescentibus, circiter 5 mm longis. Species *S. anomalae* affinis.

A shrub 2 to 3 m high, the branches reddish brown, glabrous, the branchlets slender, somewhat angled, castaneous or purplish, appressed-pubescent with short hairs. Leaves coriaceous or subcoriaceous, shining, glabrous, elliptic to oblong-elliptic, 3 to 5 cm long, 1.5 to 3 cm wide, the apex acute or shortly acuminate, base acute, margins minutely glandular-serrulate or crenulate, toward the base usually entire; lateral nerves 5 or 6 on each side of the midrib, slender, anastomosing, the reticulations lax, the midrib not impressed on the upper surface; petioles 2 to 3 mm long, glabrous or when young pubescent. Racemes axillary, solitary, or in pairs, short, few-flowered, appressed cinereous-pubescent, 8 to 10 mm long, simple, usually 5 to 10 flowers in a raceme. Flowers white, their pedicels 1.5 to 2.5 mm long, the apical bracteoles triangular-ovate, acute, about 1 mm long, somewhat pubescent. Calyx pubescent, the tube short, the limb 2.5 mm in diameter, the lobes orbicular-reniform, spreading, rounded, slightly pubescent, about 1 mm long and 1.2 mm wide. Petals glabrous, oblong-elliptic, 3 mm long. Stamens indefinite, the filaments glabrous, 3 to 4 mm long, slightly united below, forming about 5 indistinct phalanges. Ovary 3-celled; style gla-

brous, 5 mm long. Fruits sparingly appressed-pubescent, oblong-ovoid, terete, about 5 mm long.

Kwangtung Province, Kochow region, Lai Tung and Shan Mi, *To Kang P'eng 2714* (type), *2677*, February and March, 1919, the former with the local name *ye cha fa*.

This species, dedicated to Mr. C. G. Fuson, through whose interest it was possible to do some field work in the Kochow region, is distinctly allied to *Symplocos anomala* Brand of Yunnan Province, from which it differs in its shorter, much less acuminate, fewer-nerved leaves, and somewhat longer, more numerously flowered racemes.

SYMPLOCOS CHINENSIS (Lour.) Desvaux MS. in herb. Mus. Paris. comb. nov.

Myrtus chinensis Lour. Fl. Cochinch. (1790) 313.
Symplocos sinica Ker in Bot. Reg. 9 (1823) *t. 710;* Brand in Engl. Pflanzenreich 6 (1901) 34.

Loureiro's material was from the vicinity of Canton, and his description applies unmistakably to the species currently known as *Symplocos sinica* Ker. It is common on hills near Canton and is represented by the following Kwangtung material: *Merrill 10725, Levine 15, 294, 637, 1787, 2372, 3198, 3403.* The only recorded local name is *hak tsz* in the Lin District; Loureiro records the Cantonese name as *tan quat xiong.* Among the other new genera and species described by Loureiro *Dicalyx cochinchinensis* Lour. is *Symplocos cochinchinensis* Moore; *Decadia aluminosa* Lour. is apparently identical with *Symplocos spicata* Roxb.; *Drupatris cochinchinensis* Lour. is certainly a *Symplocos;* and *Myrtus zeylanica* Lour. (non Linn.) is probably a *Symplocos.* Loureiro's type of *Myrtus chinensis* is preserved in the herbarium of the Paris Museum of Natural History.

LOGANIACEAE

STRYCHNOS Linnaeus

STRYCHNOS UMBELLATA (Lour.) comb. nov.

Cissus umbellata Lour. Fl. Cochinch. (1790) 84.
Strychnos paniculata Champ. in Hook. Kew Journ. Bot. 5 (1853) 56.

Planchon,[12] in excluding Loureiro's species from the Vitaceae, suggests that it might be a *Strychnos.* I am of the opinion that this is the correct disposition of *Cissus umbellata* Lour., and

[12] DC. Monog. Phan. 5 (1887) 626.

further that it is identical with *Strychnos paniculata* Champ., a species strongly characterized by its 4-merous flowers and the only representative of the genus known from the vicinity of Canton.

LIGUSTRUM Linnaeus

LIGUSTRUM GROFFIAE sp. nov.

Frutex circiter 2 m altus, subtus foliis et ramulis et inflorescentiis perspicue molliterque ferrugineo-villosis; foliis oblongo-ovatis, usque ad 7 cm longis, acuminatis, basi acutis, supra olivaceis, nitidis, leviter pubescentibus, subtus pallidioribus, nervis utrinque circiter 6, tenuibus; inflorescentiis axillaribus, paniculatis, 5 ad 6 cm longis, ramis inferioribus usque ad 3 cm longis; floribus numerosis, corolla 4 mm longa, glabra, tubo 2 mm longo.

A shrub about 2 m high, the leaves on the lower surface and especially the branchlets and inflorescences densely and softly ferruginous-villous with spreading hairs. Branches terete, those up to 5 mm in diameter more or less pubescent, the ultimate branchlets about 2 mm in diameter. Leaves chartaceous, oblong-ovate, 5 to 7 cm long, 2.5 to 3 cm wide, apex acuminate, base acute, the upper surface olivaceous, shining, somewhat pubescent, the midrib and nerves impressed, the lower surface paler, softly villous; lateral nerves about 6 on each side of the midrib, slender; petioles 4 to 5 mm long, ferruginous-villous. Panicles axillary, 5 to 6 cm long, many-flowered, the branches usually spreading, the lower ones up to 3 cm in length. Flowers white, fragrant, their pedicels 1 to 2 mm long, glabrous; bracteoles oblong-lanceolate, somewhat acuminate, about 1 mm long. Calyx somewhat cup-shaped, glabrous, 1 to 1.2 mm long, shallowly 4-toothed. Corolla 4 mm long, the tube 2 mm long, the lobes somewhat elliptic, obtuse. Stamens exserted.

Kwangtung Province, Shiuchow region, Tan Ha Shan, *To Kang P'eng 2820,* April 24, 1919, with the local name *mo ch'ung shü.* Possibly referable to this species is *No. 2795* of the same collection from the same locality with the local name *sha yeuk shu;* this specimen, however, has much smaller leaves and much-fewer flowered inflorescences than the type.

This species is well characterized by its dense ferruginous-villous indumentum. It is dedicated to Miss Elizabeth H. Groff, through whose interest it was possible to have collections made in the Shiuchow region.

ASCLEPIADACEAE

CRYPTOLEPIS R. Brown

CRYPTOLEPIS SINENSIS (Lour.) comb. nov.

Pergularia sinensis Lour. Fl. Cochinch. (1790) 169.
Emericia sinensis Roem. & Schultes Syst. 4 (1819) 402.
Pergularia chinensis Spreng. Syst. 1 (1825) 836.
Vallaris sinensis G. Don Gen. Syst. 4 (1838) 79.
Cryptolepis elegans Wall. Cat. (1829) No. 1639, *nomen nudum*, G. Don Gen. Syst. 4 (1838) 82.
Aganosma edithiae Hance in Ann. Sci. Nat. Bot. V 5 (1866) 227.

Loureiro's material was from China, presumably from the vicinity of Canton, and has long been considered a species of doubtful status. All the synonyms cited above, except the last two, are based on Loureiro's binomial. The description applies closely to the species currently known as *Cryptolepis elegans* Wall., a species not uncommon in Kwangtung Province and represented by the following specimens: *Merrill 10806, Levine 356, 1850, 3201.* Loureiro described the seeds as naked, perhaps because he saw only those from which the coma had fallen, or perhaps because he really saw no seeds. I am convinced, however, that the species as here interpreted is the one Loureiro intended.

APOCYNACEAE

ALYXIA Banks

ALYXIA LEVINEI sp. nov.

Frutex scandens, glaber, ramis ramulisque tenuibus, olivaceis; foliis oppositis et ternatis, junioribus membranaceis, vetustioribus chartaceis ad subcoriaceis, ellipticis ad oblongis, usque ad 8 cm longis, utrinque subaequaliter angustatis, obtuse acuminatis; inflorescentiis axillaribus brevibus, breviter pedunculatis, ut videtur paucifloris; fructibus junioribus ellipsoideis, circiter 9 mm longis.

A scandent glabrous shrub, the branches and branchlets slender, the internodes up to 25 cm in length, branchlets 1.5 mm in diameter or less, somewhat angled or striate, the older branches terete, smooth, somewhat reddish brown. Leaves opposite and in whorls of three, elliptic to oblong, 5 to 8 cm long, 2 to 3 cm wide, the younger ones membranaceous, the older ones chartaceous to subcoriaceous, olivaceous, shining, subequally narrowed to the acute or somewhat acuminate base and to the bluntly acuminate apex, the nerves often obsolete, never prominent; petioles 4 to 7 mm long. Inflorescences axillary, solitary, short, apparently very few-flowered, their peduncles 5 mm long

or less, obscurely puberulent, the persistent sepals oblong, 1.5 mm long. Young fruit ellipsoid, about 9 mm long.

Kwangtung Province, Ting Woo Mountain, *Levine 1975*, May 26, 1918, scattered along the banks of streams, altitude about 300 meters.

This is the second species of the genus to be found in Kwangtung Province and differs remarkably from *Alyxia sinensis* Champ. in its much larger, differently shaped, acuminate leaves.

LABIATAE

PRUNELLA Linnaeus

PRUNELLA VULGARIS Linn. Sp. Pl. (1753) 600.

Kwangtung Province, Shiuchow region, *To Kang P'eng 2854*, April 25, 1919, with the local name *ha fú ts'o*.

A widely distributed species in the North and South Temperate Zones. Central and northern China and Formosa, but not previously recorded from Kwangtung Province.

BORAGINACEAE

TRIGONOTIS Steven

TRIGONOTIS PEDUNCULARIS (Trev.) Benth. ex Baker & Moore in Journ. Linn. Soc. Bot. 17 (1879) 384.

Myosotis peduncularis Trev. in Schrift. Naturf. Ges. Berl. 7 (1813) 147.

Kwangtung Province, Shiuchow region, *Levine 3543*, along roads, May, 1919.

The genus is new to Kwangtung Province, the species being common in central and northern China, the present locality being far south of its previously known range.

BIGNONIACEAE

DOLICHANDRONE Seemann

DOLICHANDRONE STIPULATA (Wall.) Benth. ex C. B. Clarke in Hook. f. Fl. Brit. Ind. 4 (1884) 379.

Spathodea stipulata Wall. Cat. (1832) No. 6518, *nomen nudum*, Pl. As. Rar. 3 (1832) 20, *t. 238*.

Kwangtung Province, Kochow region, Kwanshan temple, *To Kang P'eng 2726*, February 18, 1919, with the local name *mau mi muk*.

The Kwangtung specimen is with mature fruits and agrees closely with the description. The species was previously known only from Burma.

ACANTHACEAE

HEMIGRAPHIS Nees

HEMIGRAPHIS PROCUMBENS (Lour.) comb. nov.

Barleria procumbens Lour. Fl. Cochinch. (1790) 377.
Ruellia chinensis Nees in DC. Prodr. 11 (1847) 147.
Hemigraphis chinensis T. Anders. in Journ. Linn. Soc. Bot. 26 (1890) 238.
Strobilanthes scaber Hance in Journ. Bot. 16 (1878) 231, non Nees.

Loureiro's material was from the vicinity of Canton, where the species is still common, and on account of its yellow flowers is rather conspicuous in dry thickets. His description applies unmistakably to the species currently known as *Hemigraphis chinensis* T. Anders. It is represented by *Merrill 10135* and *Levine 181*.

CAPRIFOLIACEAE

LONICERA Linnaeus

LONICERA DASYSTYLA Rehder in Rept. Mo. Bot. Gard. 14 (1903) 158, *t. 4, f. 1–3*.

Kwangtung Province, North River, Sai Sha, Sz Ooi, *Groff 2402*, April 24, 1918, with the local name *kam ngan fa*.

The specimen agrees closely with Rehder's figure and description, differing in but few minor details. The leaves average smaller than in the type and are glabrous, while the older branchlets are brownish rather than grayish. The pubescent style is characteristic. Previously reported only from Tonkin.

CUCURBITACEAE

GYMNOPETALUM Arnott

GYMNOPETALUM CHINENSE (Lour.) comb. nov.

Euonymus chinensis Lour. Fl. Cochinch. (1790) 156.
Bryonia cochinchinensis Lour. op. cit. 595.
Gymnopetalum cochinchinense Kurz in Journ. As. Soc. Beng. 40[2] (1871) 57; Cogn. in DC. Monog. Phan. 3 (1881) 391.

Both of Loureiro's descriptions apply unmistakably to the species currently known as *Gymnopetalum cochinchinense* Kurz, and it is indeed curious that he should have placed a cucurbitaceous plant in the celastraceous genus *Euonymus*. The type of *Euonymus chinensis* was from the vicinity of Canton, for which Loureiro records the Cantonese name *kam qua*. It is represented by the following recently collected material from the vicinity of Canton, with the recorded names *ka shui kwah* and *ye kwah*, *Levine 1108, 1705, 2183*.

RUBIACEAE

PLECTRONIA Linnaeus

PLECTRONIA LEVINEI sp. nov.

Frutex glaber, ramis spinis longis rigidis rectis armatis; foliis chartaceis, ellipticis ad oblongo-ellipticis, 1.5 ad 4 cm longis, obtusus ad acutis, basi angustatis, acutis, nervis utrinque 2 vel 3, obscuris, subtus in axillis subobsolete glandulosis, reticulis obsoletis; fructibus axillaribus, solitariis, tenuiter pedicellatis, ovoideis, in siccitate nigris vel pruinosis, rugosis, circiter 6 mm longis.

A glabrous shrub, the branches terete or the ultimate branchlets obscurely angled. Leaves usually in pairs on two very short opposite branchlets, appearing like four leaves at each node, chartaceous, elliptic to oblong-elliptic, or sometimes somewhat obovate, rather pale when dry, slightly shining, 1.5 to 4 cm long, 1 to 2 cm wide, obtuse to acute, base narrowed, acute; lateral nerves 2 or 3 on each side of the midrib, slender, indistinct, their axils obscurely glandular on the lower surface, the reticulations obsolete; petioles 1 to 2 mm long; stipules about 1 mm long. Fruits axillary, solitary, black or somewhat pruinose, rugose, ovoid, about 6 mm long, when young crowned by the cylindric, 5-toothed, about 4 mm long calyx-tube, this soon deciduous, the pedicels 10 to 12 mm long, slender. Seeds usually two. Spines straight or slightly curved, stiff, rather slender, sharp, 1 to 1.5 cm long.

Kwangtung Province, Heung Shan District, near Macao, *Levine 3487,* January 18, 1919.

This species belongs in the group with *Plectronia horrida* Benth. & Hook. f., *P. parvifolia* Benth. & Hook. f., and *P. parviflora* Bedd., but is readily distinguished by being entirely glabrous, and by its solitary, slenderly pedicelled fruits.

WENDLANDIA Bartling

WENDLANDIA CHINENSIS sp. nov.

Species *W. paniculatae* affinis, differt stipulis hirsutis, inflorescentiis densissime cinereo-villosis, floribus dense confertis, glomeratim dispositis, more *W. tinctoriae.*

A shrub or small tree up to 8 m high, the branches glabrous or nearly so, the branchlets more or less brownish- or cinereous-pubescent. Leaves chartaceous, oblong-elliptic to oblong-lanceolate, olivaceous and shining when dry, 10 to 12 cm long, 3 to 5 cm wide, subequally narrowed to the acute base and rather slenderly acuminate apex, the upper surface very slightly sub-

strigose-hirsute with widely scattered, short hairs, the lower surface sparingly pubescent with widely scattered, short, cinereous hairs on the midrib, nerves, reticulations, and epidermis; lateral nerves about 10 on each side of the midrib, distinct; petioles 5 to 10 mm long; stipules coriaceous, persistent, orbicular-reniform, somewhat hirsute, 7 to 9 mm wide, rounded, sometimes contracted below and distinctly stipitate. Panicles terminal, ample, up to 20 cm long and wide, densely cinereous-villous. Flowers very numerous, densely crowded in glomerules on the ultimate branches; bracts 5 to 7 mm long. Calyx densely cinereous-villous, about 2.5 mm long, the lobes oblong. Corolla-tube 4 to 5 mm long, slender, glabrous externally, sparingly pubescent within.

Kwangtung Province, Kochow region, Shek Kau Tong, *To Kang P'eng 2691* (type), March 6, 1919. To this species I also refer the following specimens, both described as shrubs about 2 m high, both with somewhat smaller leaves than the type and with unopened flowers: *To Kang P'eng 2754, 2702*, the former from Sheung Ko Wan, with the local name *fo shiu nap*, the latter from Shek Ling, with the local name *chü lüt shü*.

This species is manifestly allied to *Wendlandia paniculata* (Roxb.) DC., the type of which was from the Molucca Islands. Comparison with Amboina material, *Robinson 1731*, representing the typical form of Roxburgh's species, shows that the Chinese form differs radically in its very densely cinereous-villous inflorescences and calyces, and in its very densely crowded flowers, in the disposition of the flowers strongly resembling *Wendlandia tinctoria* DC. The Chinese form described by Hance as *Wendlandia uvariifolia* has been reduced to *Wendlandia paniculata* DC. It is represented by *Levine 2338*, from the North River region, and is distinctly different from *Wendlandia paniculata* and I believe should be retained as of specific rank under Hance's name. It differs from both *Wendlandia paniculata* DC. and *W. chinensis* Merr. in its leaves being rather densely ferruginous-pubescent beneath, while the disposition of the flowers and the indumentum of the inflorescences and calyces are quite different from the latter species.

MUSSAENDA Linnaeus

MUSSAENDA PARVIFLORA Miq. Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 110.

Kwangtung Province, Ting Woo Mountain and at Wan Lo Mountain, Kochow region, *Levine 1979, To Kang P'eng 2692*, April, 1918, and March, 1919.

The specimens agree closely with Formosan material and also conform to Miquel's description. I believe this to be, at least in part, the Kwangtung form referred by Dunn and Tutcher to *Mussaenda frondosa* Linn., but I have seen no Chinese material at all approaching the typical Ceylon form of the Linnean species.

RANDIA Linnaeus

RANDIA ACUMINATISSIMA sp. nov.

Arbor parva, usque ad 8 mm alta, ramulis et inflorescentiis et subtus foliis ferrugineo-pubescentibus; foliis chartaceis, oblongo-ellipticis ad oblongo-lanceolatis, usque ad 20 cm longis, utrinque angustatis, basi acutis, apice tenuiter caudato-acuminatis, supra in siccitate olivaceis, glabris, nitidis; nervis utrinque 10 ad 12, subtus perspicuis; stipulis lineari-lanceolatis, acuminatis, usque ad 1 cm longis; cymis oppositifoliis, 3 ad 4 cm longis, breviter pedunculatis; floribus ad apices ramulorum confertis, calycis segmentis lanceolatis, acuminatis, circiter 1.5 mm longis; fructibus globosis, glabris, 6 ad 8 mm diametro, in siccitate nigris, nitidis; seminibus numerosis, compressis, circiter 1.5 mm diametro.

A small tree about 8 m high, the branchlets, inflorescences, and the lower surface of the leaves rather densely ferruginous-pubescent. Branches dark reddish brown, usually terete, glabrous. Leaves oblong-elliptic to oblong-lanceolate, chartaceous, 11 to 20 cm long, 4 to 7 cm wide, subequally narrowed below to the acute, equilateral base, and above to the slenderly caudate-acuminate apex, the acumen sometimes falcate, the upper surface glabrous, olivaceous and shining when dry, the lower surface rather softly pubescent; lateral nerves 10 to 12 on each side of the midrib, prominent on the lower surface, anastomosing, the reticulations rather lax, distinct; petioles usually pubescent, 5 to 8 mm long; stipules linear-lanceolate, acuminate, pubescent, up to 1 cm long. Cymes leaf-opposed, shortly peduncled, ferruginous-pubescent, 3 to 4 cm long (corollas unknown), the flowers sessile or shortly pedicelled and somewhat crowded at the tips of the branchlets. Calyx ferruginous-pubescent, about 4 mm long, the lobes lanceolate, acuminate, about 1.5 mm long. Fruits globose, glabrous, 6 to 8 mm in diameter, black and shining when dry. Seeds many, flattened, orbicular-ovate to ovate, about 1.5 mm long.

Kwangtung Province, White Cloud Mountain, *Levine 3130 (type) 3267*, August 29, November, 1918; Kong Moon, *Groff*

2471, March, 1918; Ukantin, *Hongkong Herbarium 10918*, distributed as *Randia densiflora* Benth.

This species is manifestly allied to *Randia racemosa* (Cav.) F.-Vill. (*R. densiflora* Benth.), from which it is easily distinguished by its indumentum.

COMPOSITAE

GYNURA Cassini

GYNURA SEGETUM (Lour.) comb. nov.

Cacalia segetum Lour. Fl. Cochinch. (1790) 486, in nota.
Cacalia pinnatifida Lour. l. c. non Linn.
Gynura pinnatifida DC. Prodr. 6 (1837) 301.

Kwangtung Province, Kochow region, Kwong T'am Mountain, *To Kang P'eng 2671*, March 22, 1919, in a garden, with the local name *tung fung ip*.

The type of Loureiro's species was from Canton, where he observed it growing in rice paddies. He records the Cantonese name as *cien fan sat*. His description applies closely to the specimen cited above. I consider his specific name *pinnatifida* to be invalidated by the earlier *Cacalia pinnatifida* Linn., an entirely different species, and hence adopt the casual name published by him: "unde vernaculum nomen Sinense *Cacalia Segetum*."

CROSSOSTEPHIUM Lessing

CROSSOSTEPHIUM CHINENSE (Linn.) comb. nov.

Artemisia chinensis Linn. Sp. Pl. (1753) 649, excl. syn. Gmelin; Lour. Fl. Cochinch. (1790) 492.
Artemisia judaica Lour. Fl. Cochinch. (1790) 489, non Linn.
Crossostephium artemisioides Less. ex Cham. & Schlecht. in Linnaea 6 (1831) 220.

The genus *Crossostephium* was based on cultivated specimens from Manila and from Canton, the species being widely cultivated in Japan, China, the Philippines, and Indo-China. I have seen no specimens from wild plants, although the species is manifestly a native of either China or Japan. It is currently known in Manila, where it is cultivated in pots, as *ajenjo*, a Spanish name properly belonging to *Artemisia*. The type of the Linnean species was a specimen collected in China by Lagerstroem, and the Linnean description based on this specimen clearly applies to the species currently known as *Crossostephium artemisioides* Less. The species is still common in cultivation in Canton. Both of Loureiro's descriptions cited above apply to this species.

EMILIA Cassini

EMILIA PRENANTHOIDEA DC. Prodr. 6 (1837) 303.

Kwangtung Province, Teng Woo Mountain, *Levine 2041, 3221*, May 26, 1918.

India to the Philippines; this species has previously been tentatively recorded from China by Forbes and Hemsley,[13] who state that in preparing their list they had recorded the species from China on the basis of a specimen collected by Fortune, but that the specimen was not to be found at the time their manuscript was written. The species is readily distinguished from *Emilia sonchifolia* DC. not only by its narrow leaves, but also by its involucral bracts being much shorter than the flowers and by its glabrous achenes.

SENECIO Tournefort

SENECIO OLDHAMIANUS Maxim in Bull. Acad. Pétersb. 16 (1871) 219.

Kwangtung Province, Shiuchow region, *To Kang P'eng 2852*, April 25, 1919, in grassy places.

Not previously recorded from Kwangtung Province; common in central China.

[13] Journ. Linn. Soc. Bot. 23 (1888) 449.

NOTIZ UEBER HOYA IMBRICATA CALLERY EX DECAISNE UND HOYA PSEUDOMAXIMA KDS. IN DEN FILIPINEN AUF GRUND VON EINIGEN HERBAR-EXEMPLAREN DES BUREAU OF SCIENCE IN MANILA

Von S. H. KOORDERS

Buitenzorg, Java

MIT VIER TAFELN

1. HOYA IMBRICATA Callery ex Decaisne, forma TYPICA Kds. Taf. I.

Decaisne giebt in DC. Prodromus 8 (1844) 637 folgende von ihm in Delessert, Icones selectae plant. 5 (1846) 37 und später von Miquel, Flora Indiae Batav. 2 (1857) 520, unverändert übergenommene Spezies-Beschreibung von *Hoya imbricata:*

Scandens radicans, foliis abortu alternis unilateralibus imbricatis orbicularibus supra convexis aveniis subtus venosis marginibus reflexis, pedunculis multifloris, pedicellis gracilibus glabris, callyce brevi, corollae laciniis triangularibus acutis, coronae stam. fol. supra convexiusculis marginibus revolutis angulo int. porrecto antherumque membrana attenuata stigmati apiculato incumbentibus, folliculis laevibus. Frutex scandens arbor. truncis conjunctissime affixus. (Decne. l. c.)

Von dieser characteristischen, bisher im Buitenzorger Herbar fehlenden Art, erhielt ich leihweise aus dem Herbarium des Bureau of Science in Manila, von Herrn E. D. Merrill, folgendes von ihm in den Filipinen gesammeltes Herbar-Exemplar:

LUZON, Rizal Province, Tanay, *Merrill 2363,* ausgeblüht im Mai, 1903.

Dieses Exemplar ist von Merrill etikettiert: *Hoya imbricata* Dcne., und von ihm mit folgender Bemerkung versehen: "This should be typical *H. imbricata.* Leaves mottled, green and purple."

Das Exemplar wurde nach seiner Angabe von ihm gesammelt ziemlich nahe bei dem Fundort von den authentischen Exemplar von *Hoya imbricata* des Pariser Herbar. Es besteht aus einem Blütenzweig mit 4 sich dachziegelig deckenden Blättern und einem ausgeblühten Blütenstand, und einer Papierkapsel mit einem einzelnen Laubblatt.

Von allen mir aus dem Herbarium des Bureau of Science in Manila, unter dem Namen *Hoya imbricata* leihweise zuge-

schickten Herbarexemplaren, stimmt kein einziges so gut überein mit der Beschreibung und Abbildung von *Hoya imbricata* in DeCandolle Prodromus, und in Delessert, wie obengenanntes Spezimen (*Merrill 2363*), dass es als "Topotype" (im Merrill-schen Sinne) von *Hoya imbricata* betrachtet werden darf.

Über dieses bemerkenswerte Herbarexemplar (*Merrill 2363*) lasse ich folgende Beschreibung folgen:

Blätter kreisrund, ± ganzrandig oder eckig-ausgeschweift, am Grunde abgerundet-abgestutzt, oben abgerundet oder emarginat; oberseits convex, ohne deutliche Nerven, völlig kahl und glatt (auch ohne Cuticular-Höcker); unterseits concav (auch ohne Cuticular-Höcker); ± in der Mitte dem sehr kurzen, fast fehlenden Blattstiel peltat inseriert und handnervig, mit undeutlichen, gabelig verzweigten Nerven; ± 9 cm lang und 10 cm breit. Epidermis des Blatt-Oberseite ohne Haare, mit ± glatter oder schwachwelliger etwa 20 μ dicker Cuticula, fast ohne Cuticular-Höcker und dadurch aussen ± glatt (nicht körnigrauh) aussehend. Epidermis Zellen des Blattes Unterseite je mit einem wagerecht abstehendem, einzelligem, unverzweigtem, fadenförmigem oder schmalkegelförmigem, spitzem, glattem, inhaltlosem, farblosem, gerade oder ± gekrümmtem, 30–50 μ langem Haar versehen und mit nur 5 μ dicker Cuticula. Stengel stielrund, ± 4 mm Durchmesser, kahl (auch ohne Papillen Cuticular-Höcker), mit zahlreichen, dichtstehenden Haftwurzeln, welche meistens ganz oder fast ganz von den dachig deckenden Laubblättern geschützt sind. Pedunculus axillar (in sicco abstehend), ± 10 cm lang, stielrund, kahl; rhachis ± 9 cm lang, kahl, dicht bedeckt mit den Narben der abgefallenen Pedicelli, spindelförmig, in der Mitte fast 1 cm breit.

Dieses Exemplar (*Merrill 2363*) ist von mir *Hoya imbricata* Callery ex Decaisne, forma *typica* Kds. (msc. 1918) etikettiert worden.

2. HOYA IMBRICATA Callery forma BASI-SUBCORDATA Kds. forma nov. Taf. II, III.

A typo recedit foliis basi subcordatis.

Blätter kreisrund, ± ganzrandig, oben abgerundet, am Grunde bis 1 cm (oft nur 0.5 cm) untief-herzförmig, ± in der Mitte peltat, dachig deckend, bisweilen (*Copeland 399*) auseinander entfernt. Blüten ± wie der Typus. Früchte unbekannt.

Die folgenden 3 Exemplare des Manila-herbars halte ich für diese neue Form (foliis basi-subcordatis) von *Hoya imbricata*:

BILIRAN, *Bur. Sci. 18893 McGregor*, blühend im Juni, 1914.

MINDANAO, Davao District, bei Davao, *Copeland 399*, blühend im März, 1904. SAMAR, *Bur. Sci. 24910 Edaño.*

Diese Exemplare stimmen Beide im Blütenbau mit der Beschreibung und Abbildung von *Hoya imbricata* in Decaisne gut überein, und besitzen obenso wie auch *Merrill 2363*, beiderseits völlig kahle Blätter (die auch keine Cuticular-Höcker haben), jedoch ist der Blattfuss deutlich "subcordat". Die Tiefe des herzförmigen Blattfuss-Einschnittes beträgt ± 0.5–1 cm.

Die Blüten von *Bur. Sci. 18893 McGregor* sind noch nicht völlig ausgebildet und kleiner als von *Copeland 399*. Bei beiden Exemplaren liegen keine Früchte vor.

Mit obiger forma *basi-subcordata* zeigt folgendes Filipinen-Exemplar einige Ähnlichkeit, jedoch ist die Korolla auf innen auffallend dicht behaart: SAMAR, Catubig River, *Bur. Sci. 24910 Edaño*. Blühend im Februar-März, 1916. Diesem Exemplar ist von Merrill folgende Bemerkung hinzugefügt: "Flowers appear to be different from *Hoya imbricata*." Auch bei diesem Exemplar sind keine Früchte vorhanden. Vielleicht liegt hier eine von *Hoya imbricata* neue Spezie vor.

3. HOYA PSEUDOMAXIMA Kds. sp. nov. Taf. IV.

A *Hoya imbricata* Callery foliis basi profunde cordatis et a *Hoya maxima* Kds. foliis supra glaberrimis et apice haud raro emarginatis differt.

LUZON, Rizal Province, Bosoboso, *Bur. Sci. 22089 Ramos*, blühend am 7ten December, 1913.

Blätter kreisrund, am Grunde bis 3 cm tief-herzförmig, oberseits völlig kahl (nicht nur unbehaart, sondern auch ohne Cuticular-Höcker) und glatt, unterseits kahl und auch ohne Cuticular-Höcker, bis 8 cm lang und 9 cm breit. Blüten ± wie *Hoya imbricata*, Früchte unbekannt.

Bemerkung: Während bei allen (12) Einsammlungs-Nummern meiner *Hoya maxima* aus Nord-Ost-Celebes (*Kds. n. 16204 β*, u.s.w.) die Blatt-Oberseite stets mit Cuticular-Höckern dicht bedeckt ist, welche dauernd oder seltener nur in der Jugend je ein Flaumhaar tragen, bei der nur aus den Filipinen (Mount Isarog) bekannten *Hoya pseudomaxima* ist die Blatt-Oberseite völlig glatt (glaberrima) ohne Cuticular-Höcker und ohne Flaumhaare.

ERKLÄRUNG DER ABBILDUNGEN

[Originalzeichnung von Mangoendimedjo, direxit Koorders; Nachzeichnung von J. K. Santos.]

TAFEL I

Hoya imbricata Callery ex Decaisne, forma *typica* Kds.

FIG. 1. Blütenzweig mit ausgeblühtem Blütenstand, wovon alle Blüten abgefallen sind.
2. Blatt, Unterseite.
3. Ausgeblühter Blütenstand.
4. Querschnitt durch die Epidermis der Blatt-Oberseite.
5. Idem der Blatt-Unterseite. (Original, nach *Merrill 2363* in Herb. Bureau of Science in Manila. Gesammelt in den Filipinen, auf Luzon, in der Provinz Rizal bei Tanay, im ausgeblühtem Zustand, im Mai, 1903.) In dieser Gegend wurde nach der brieflichen Mittheilung von Merrill das Original von *Hoya imbricata* gesammelt. Damit stimmt Herb. *Merrill 2363* nach der Abbildung und nach der Beschreibung von Decaisne vorzüglich überein. Auf der Original-Einsammlungs-Etikette von *Merrill 2363* steht: "leaves mottled, green and purple." Ferner wurde von ihm auf seinem mir geliehenen Original-Herbarbogen folgendes erwähnt: "This should be typical *Hoya imbricata.*"

TAFEL II

Hoya imbricata Callery forma *basi-subcordata* Kds.

FIG. 1. Blütenzweig, Unterseite.
2. Blattzweig, Oberseite.
3. Blattzweig, Unterseite.
4. Blütenstand.
5. Blüte. (Original, nach *Bur. Sci. 18893 McGregor.*)

TAFEL III

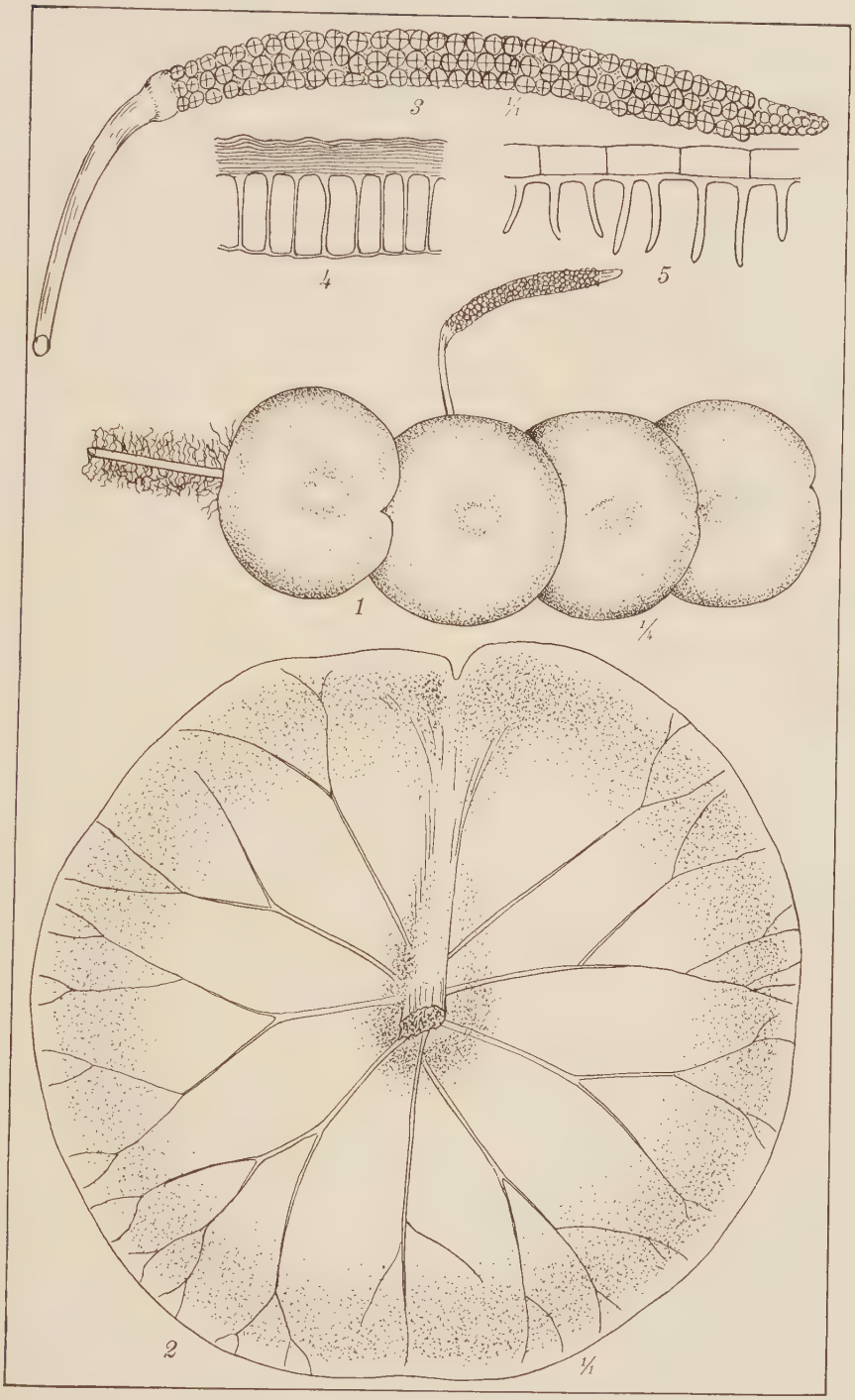
Hoya imbricata Callery forma *basi-subcordata* Kds.

FIG. 1. Blütenzweig, Unterseite.
2. Blüte.
3. Translatoren. (Original, nach *Copeland* 399.)

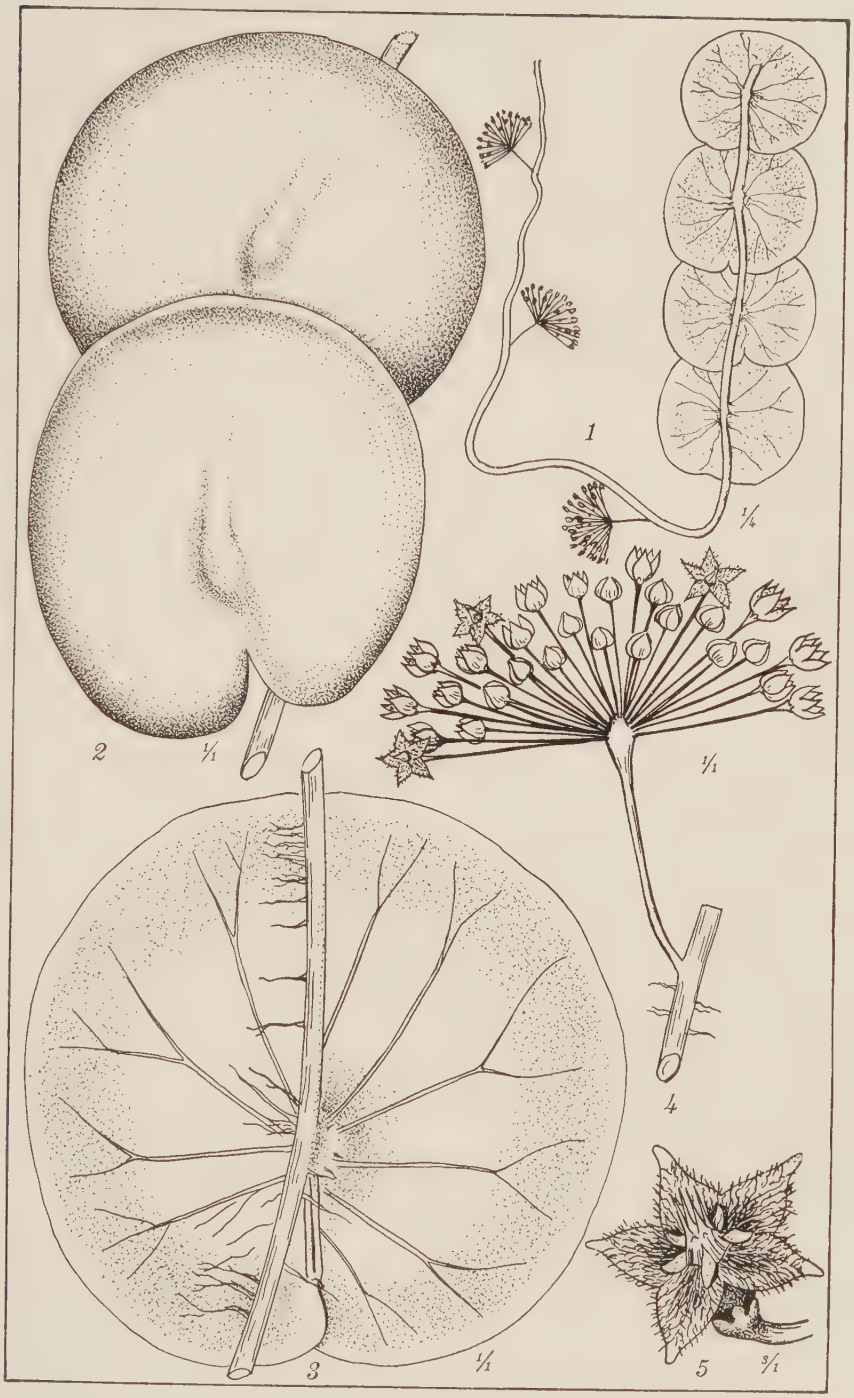
TAFEL IV

Hoya pseudomaxima Kds.

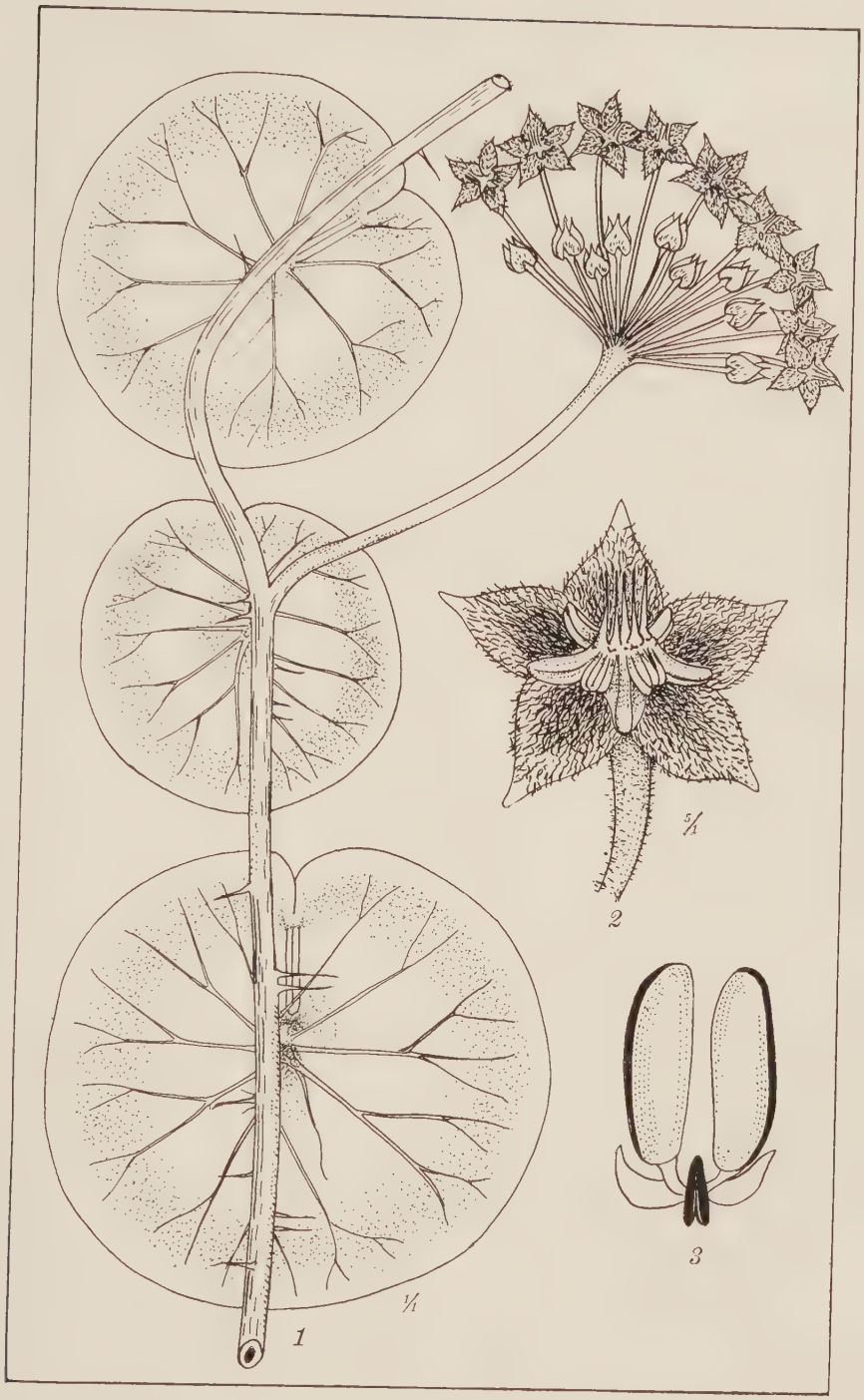
FIG. 1. Blattzweig, Oberseite.
2. Blüte.
3. Blüte.
4. Translatoren.
5. Blattzweig, Oberseite.
6. Blatt, Unterseite.
7. Blütenzweig.
8. Blüte. (Original, 1–4 nach *Bur. Sci. 970 Ramos;* 5–8 nach *Bur. Sci. 22089 Ramos.*)



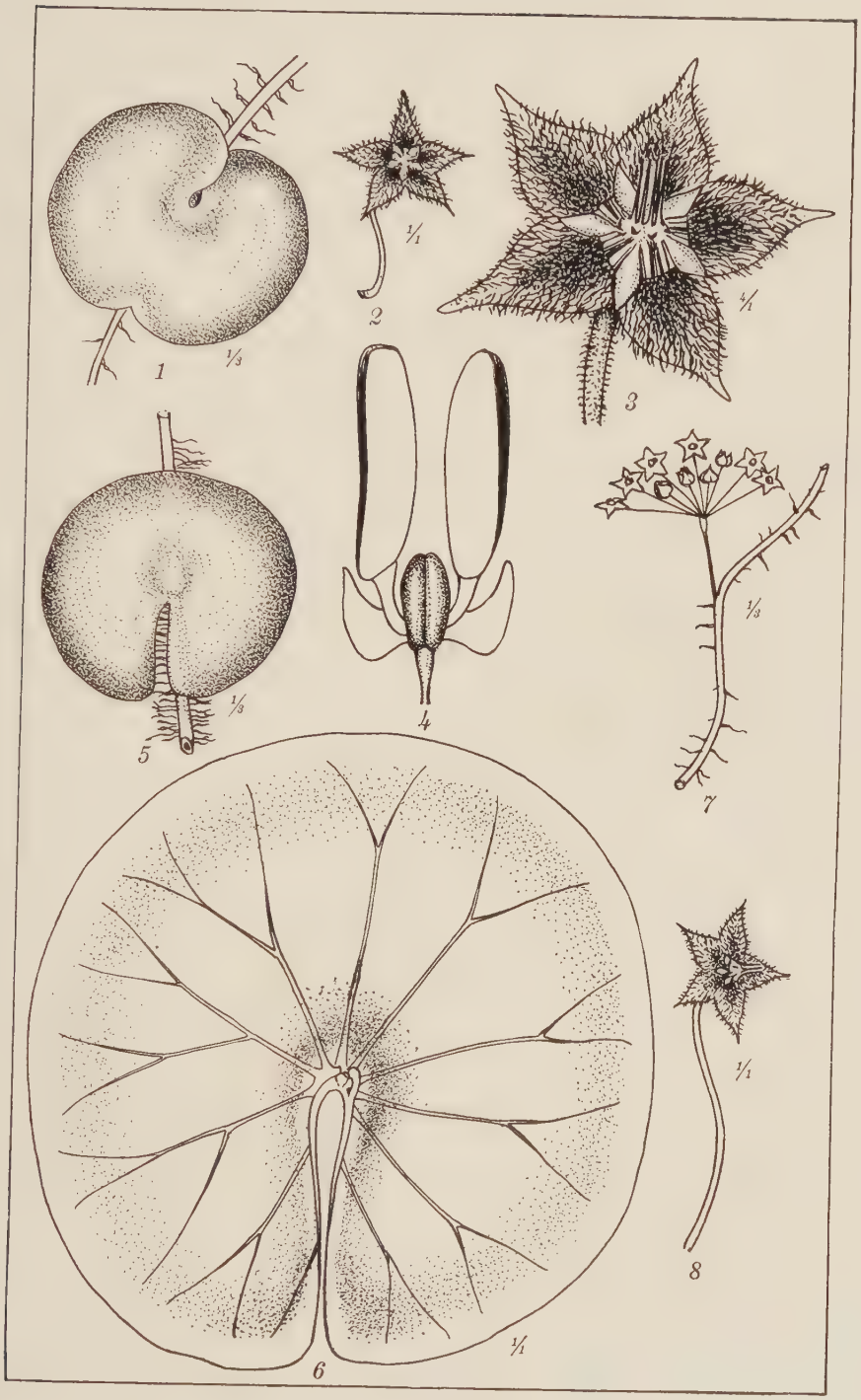
TAFEL I. HOYA IMBRICATA CALLERY EX DECAISNE, FORMA TYPICA KOORD.



TAFEL II. HOYA IMBRICATA CALLERY, FORMA BASI-SUBCORDATA KOORD.



TAFEL III. HOYA IMBRICATA CALLERY, FORMA BASI-SUBCORDATA KOORD.



TAFEL IV. HOYA PSEUDOMAXIMA KOORD.

THE BLACK HALICTINE BEES OF THE PHILIPPINE ISLANDS

By T. D. A. COCKERELL

Of the University of Colorado

The black halictine bees of the Philippines have all been referred to the genus *Halictus;* but the subgenus *Nesohalictus,* of Crawford, remarkable for its very long tongue, may be elevated to generic rank.

Genus NESOHALICTUS Crawford

Halictus subgenus *Nesohalictus* CRAWFORD, Proc. U. S. Nat. Mus. 38 (1910) 120.

"Closely resembles *Halictus,* but differs by the greatly elongate tongue, which is about as long as the antennæ, by having the inner spur of the hind tibiæ in the male armed with a few large teeth, and by having all the transverso-cubital veins, the cubitus beyond the second transverse cubital, and the upper two-thirds of the second recurrent vein, obsolescent." (*Crawford.*) This diagnosis was based on the male.

The female is larger (about 7.5 millimeters long), with the basitarsi piceous (they are ferruginous in the male); the hind spur has long spines. On account of the long linear tongue the genus is related to *Thrinchostoma,* but it differs in the structure of the hind legs, the absence of the hair patch on the wings of the male, and in other ways. The clypeus of the male is entirely black, flattened and shining in the middle.

Nesohalictus robbii (Crawford).

Halictus (*Nesohalictus*) *robbii* CRAWFORD, Proc. U. S. Nat. Mus. 38 (1910) 120.

LUZON, Manila (*M. L. Robb and R. E. Brown*): Laguna Province, Mount Maquiling (*C. F. Baker*), Los Baños (*Baker*). PANAY, Antique Province, Culasi (*R. C. McGregor*), June, 1918; Maralison Island (*McGregor*), June 18, 1918. MINDANAO, Dapitan, Davao, and Cagayan (*Baker*). Another species of this genus, *Nesohalictus lativentris* (*Halictus lativentris* Friese), occurs in Java.

Genus HALICTUS Latreille

The metallic species have been previously described, but one described below (*H. opisthochlorus*) is partly metallic. The

species of *Halictus* are ground-nesting bees of relatively feeble flight, and the wide distribution of several species through the islands of the Archipelago is rather surprising. The smaller species are sometimes referred to as sweat bees, from their habit of settling on the skin, apparently attracted by the perspiration. Is it perhaps possible that they occasionally attach themselves to birds, and thus get carried about? The following key should suffice for the separation of the species before me. I include *Nesohalictus*, as it is likely to be mixed with *Halictus*.

Males ..... 1.
Females ..... 8.

1. Clypeus with a yellow or whitish transverse apical band ..... 2.
   Clypeus entirely black ..... 4.
2. Tibiæ yellow, with dark markings; scape with a light stripe; area of metathorax not plicate or only very delicately so near base. eschscholtzi sp. nov.
   Tibiæ mainly or wholly dark ..... 3.
3. Flagellum ferruginous beneath; hind tarsi or, at least, basitarsi yellow. philippinensis Ashmead.
   Flagellum dark or dusky beneath; hind tarsi dark. philippinensis nigritarsellus var. nov.
4. Mesothorax dull or dullish ..... 5.
   Mesothorax shining ..... 6.
5. Larger; stigma pale ferruginous; tarsi light red. Nesohalictus robbii Crawford.
   Smaller; stigma dark brown; tarsi dark ..... melanurops sp. nov.
6. Head very large; scape largely red; anterior knees red .... scapalis sp. nov.
   Head not unusually large ..... 6a.
6a. Very small species; mesothorax highly polished, without conspicuous punctures ..... lionotulus sp. nov.
   Small species; mesothorax shining, but finely and distinctly punctured. itaminus sp. nov.
   Larger; mesothorax with evident punctures ..... 7.
7. Mesothorax coarsely punctured; first abdominal segment closely punctured all over ..... baguionis Crawford.
   Mesothorax polished, more finely punctured; first abdominal segment without evident punctures ..... luzonicus Strand.
8. Tibiæ mainly yellow or reddish yellow; tubercles yellow. eschscholtzi sp. nov.
   Tibiæ and tubercles not thus yellow ..... 9.
9. Mesothorax dull, without evident sculpture ..... 10.
   Mesothorax more or less shining or evidently sculptured ..... 12.
10. Metathorax dark green (Baguio) ..... opisthochlorus sp. nov.
    Metathorax black, the area granular, without evident sculpture ..... 11.
11. Apical part of metathoracic area shining and with a median groove (Puerto Princesa) ..... caroli sp. nov.
    Apical part of area entirely dull; larger species (Culasi and Mount Maquiling) ..... mcgregori sp. nov.

12. Area of metathorax entirely dull, very coarsely reticulate. thoracicus sublustrans subsp. nov.
Area of metathorax shining or closely sculptured....13.
13. Large species, with dark tegulæ and very coarsely punctured mesothorax; apical area of first abdominal segment closely punctured. baguionis Crawford.
Mesothorax not thus coarsely punctured....14.
14. Scutellum sparsely punctured....15.
Scutellum closely or finely punctured, often dullish or dull....22.
15. Scutellum dullish, with large, very sparse punctures; mesothorax dull, with large sparse punctures (Mount Banahao).... oligostictus sp. nov.
Scutellum shining; mesothorax with fine or close punctures....16.
16. Mesothorax highly polished, little punctured; tegulæ amber....17.
Mesothorax dull or distinctly punctured....18.
17. Hind margins of abdominal segments testaceous; area of metathorax distinctly striate, except the shining apical part (Mount Maquiling). lionotulus sp. nov.
Hind margins of abdominal segments not testaceous; area of metathorax not distinctly sculptured (Mount Banahao). scintillans sp. nov.
18. Head very large; scape largely red; anterior knees red in male; female unknown (Mount Banahao).... scintillans sp. nov.
Head not large; scape dark; abdomen with distinct bands of tomentum at bases of at least some of the segments....19.
19. Larger species; middle of hind basitarsi with ferruginous hair on inner side; mesothorax shining and with very distinct punctures. luzonicus Strand.
Smaller species; basitarsi without strongly red or orange hair....20.
20. Stigma pale testaceous; area of metathorax shining, with very distinct longitudinal plicæ; first abdominal segment with a tuft of white hair on each side.... philippinensis Ashmead.
Stigma dark....21.
21. Disk of mesothorax very sparsely punctured; posterior truncation of metathorax brilliantly shining (Baguio).... postlucens sp. nov.
Disk of mesothorax much more closely punctured; posterior truncation dull or dullish, except upper end.... itaminus sp. nov.
22. Hind margins of at least some of the abdominal segments pale testaceous; tegulæ rufotestaceous; stigma dull reddish, not dark....23.
Hind margins of abdominal segments not testaceous....25.
23. Testaceous band on second abdominal segment in middle occupying about half of segment; first segment with broad testaceous margin; hind tibiæ and tarsi dull reddish (Mount Maquiling). fulvovittatus sp. nov.
Testaceous band on second abdominal segment, if present, not occupying a fourth of segment....24.
24. Larger; truncation of metathorax distinctly margined above (Davao). davaonis sp. nov.
Smaller; truncation not bounded above.... nesiotus Crawford.
Like the last, but more robust, with red knees and redder tegulæ. nesiotus domitus var. nov.

25. Second abdominal segment wholly without basal band or patches of tomentum; mesothorax dull; punctures of scutellum very irregular; area of metathorax dullish, with strong plicæ (Mount Banahao and Imugan) ..... melanurops sp. nov.
Second abdominal segment with basal band or lateral patches of tomentum ..... 26.
26. First recurrent nervure meeting second transverse cubital; tongue linear. Nesohalictus robbii (Crawford).
First recurrent nervure joining second submarginal cell; mouth parts ordinary for the genus; hair of postscutellum light fulvous. banahaonis Cockerell.

Halictus itaminus sp. nov.

Female.—Length, about 6 millimeters; black, with thin white hair, conspicuous on sides of thorax and forming a dense tomentum on postscutellum; head normal, face broad but eyes strongly converging below, clypeus somewhat produced; mandibles black, reddish at end; underside of head flattened, finely and densely striate; antennæ dark, the flagellum faintly brownish beneath; front dull, extremely densely punctured; clypeus irregularly punctured; mesothorax shining but not highly polished, the punctures distinct and well separated, the median groove well developed; scutellum convex, shining, sparsely punctured, with no median groove (*H. gedensis* has it dullish, with a median groove); area of metathorax appearing roughened (but under microscope seen to be reticulated) at middle and base, the posterior part at side being smooth (microscopically tessellate), while the posterior middle is somewhat swollen, with a median depression; posterior truncation dull except upper part, which is shining, its sides angular; sides of thorax dull, except a shining area below the wings; tegulæ piceous; wings dusky, stigma (which is large) and nervures piceous; first recurrent nervure meeting second transverse cubital; legs black, with pale hair; hind spur with long spines; abdomen shining, with white hair bands, broadest laterally (not always clearly visible) at bases of second and third segments; venter with white hair.

Male.—Very much like the female, but smaller and slenderer; clypeus entirely black; legs entirely dark; mesothorax shining.

LUZON, Laguna Province, Mount Maquiling, 10 females and 8 males (the type is a female); Mount Banahao, 1 female: Mountain Province, Baguio, 1 female. All from Baker.

This is very close to certain species of Java, *H. gedehensis* Friese and especially *H. gedensis* Ckll., differing from the latter especially in the scutellum, as is indicated in the preceding description.

Halictus nesiotus Crawford.

Halictus nesiotus CRAWFORD, Proc. Ent. Soc. Washington 19 (1918) 169.

LUZON, Mountain Province, Baguio (*Wirt Robinson*), type locality: Laguna Province, Mount Maquiling (*Baker*), 4 females; Mount Banahao (*Baker*), 1 female. I have not seen Crawford's type, but he has kindly confirmed my identification from a specimen sent to him.

Halictus nesiotus var. domitus var. nov.

Another specimen from Mount Banahao is more robust, with red knees, bright ferruginous tegulæ, and third and fourth abdominal segments (but not first and second) rather broadly margined with testaceous. It may be a distinct species, but for the present it may stand as a variety.

Halictus baguionis Crawford.

Halictus baguionis CRAWFORD, Proc. Ent. Soc. Washington 19 (1918) 170.

LUZON, Mountain Province, Baguio (*Robinson, Baker*): Mount Banahao (*Baker*): Nueva Vizcaya Province, Imugan (*Baker*).

This species appears to be abundant at Baguio, but a few specimens have been seen from other localities. I have one of Crawford's cotypes.

Halictus luzonicus Strand.

Halictus luzonicus STRAND, Berl. Ent. Zeitschrift 54 (1909) 208.
? *Halictus manilæ* ASHMEAD, Canad. Ent. 36 (1904) 281.
Halictus manilæ COCKERELL, Proc. U. S. Nat. Mus. 36 (1909) 420; CRAWFORD, Proc. Ent. Soc. Washington 19 (1918) 169, 170.

Strand's type was from Luzon (*Jagor*); Ashmead's, from Manila (*Stanton*). Ashmead's type, preserved in the United States National Museum, is the same as *H. luzonicus;* but Ashmead's description states that the insect, a female, is only 6 millimeters long, and the head from the base of the antennæ upward is greenish metallic. It appears probable that Ashmead began his description with one thing and finished with another, accidentally picking up the wrong specimen. At all events, I know of no species agreeing with his description and prefer to use the name *luzonicus,* which is supported by a full and accurate account of the characters.

LUZON, Mountain Province, Baguio (*Robinson, Baker*): Laguna Province, Los Baños (*Baker*); Mount Maquiling (*Baker*):

Nueva Viscaya Province, Imugan (*Baker*). It appears to be abundant at Baguio, but is represented by a few specimens from the other localities.

Halictus philippinensis Ashmead.

Halictus philippinensis ASHMEAD, Proc. U. S. Nat. Mus. 28 (1904) 128; COCKERELL, Proc. U. S. Nat. Mus. 36 (1909) 419; CRAWFORD, Proc. Ent. Soc. Washington 19 (1918) 169, 170.

LUZON, Manila (*Stanton*): Laguna Province, Los Baños (*Baker*); Mount Maquiling (*Baker*): Mountain Province, Baguio (*Baker*): Tayabas Province, Malinao (*Baker*). LEYTE, Tacloban (*Baker*). PANAY, Antique Province, Culasi (*McGregor*), June, 1918. NEGROS, Cuernos Mountains (*Baker*). MINDANAO, Davao (*Baker*); Cagayan (*Baker*); Zamboanga (*Baker*). BASILAN (*Baker*). PALAWAN, Puerto Princesa (*Baker*).

This is the commonest and most widespread *Halictus* in the Archipelago, extending from Luzon to Mindanao and Palawan, A specimen from Los Baños carries a manuscript name given by Friese.

Halictus philippinensis var. nigritarsellus var. nov.

Male.—Hind tarsi dark; flagellum dark or dusky beneath. The tarsi are entirely without yellow, but the last joint is ferruginous apically. Type of the variety from Pagsanhan, Laguna Province; others from Mount Maquiling and Los Baños, Luzon. All from Baker.

Halictus thoracicus sublustrans subsp. nov.

Female.—Length, about 6 millimeters; similar to *H. thoracicus* Friese, from Java, but with the abdomen shining and tegulæ, stigma, and nervures piceous or black. The dense tomentum on the postscutellum is white, often with a delicate ocherous tint. The species is very peculiar for the wholly dull area of the metathorax, with large reticulations, and especially for the sculpture of the mesothorax, which appears rough under a lens but under the microscope is seen to have a raised network or cancellation all over, entirely different from the fine tessellation often seen on the thorax of bees.

LUZON, Nueva Viscaya Province, Imugan (*Baker*), 5 (including the type): Mount Banahao (*Baker*), 2. PANAY, Antique Province, Culasi (*McGregor*), 3, at flowers of *Homalanthus populneus* Pax, June 3, 1918.

Halictus thoracicus var. merescens var. nov.

Female—Tegulæ rufous or rufotestaceous, sometimes darker; stigma reddish brown to dark brown.

LUZON, Mount Banahao (*Baker*) 7; Los Baños (type locality of variety) (*Baker*), 3; Mount Maquiling (*Baker*), 5. PANAY, Antique Province, Culasi (*McGregor*), 1, at flowers of *Homalanthus populneus* Pax, June 3, 1918. LEYTE, Tacloban (*Baker*), 1. MINDANAO, Davao (*Baker*), 1.

I have seen true *H. thoracicus* Friese from Buitenzorg, Java (*Bryant and Palmer*).

Halictus banahaonis Cockerell.

Halictus banahaonis COCKERELL, Ann. & Mag. Nat. Hist. VIII 14 (1914) 365; 15 (1915) 264; CRAWFORD, Proc. Ent. Soc. Washington 19 (1918) 169.

LUZON, Mount Banahao (*Baker*), 4; Paete (*Baker*), 1.

The hind margin of the first abdominal segment is lineolate, not punctured all over as in *baguionis* Crawford, contrary to the statement in Crawford's table, loc. cit.

Halictus banahaonis var. macerula var. nov.

Female.—Smaller; anterior wing, about 5 millimeters long (about 6 millimeters in type); length of insect, 6 to 6.5 millimeters.

LUZON, Mount Banahao (*Baker*), 18. The difference of size and bulk is very conspicuous, and the two lots are uniform. Presumably the two forms are adapted to different flowers. The type of the variety is *Baker 2556.*

Halictus eschscholtzi sp. nov.

Halictus manilæ STRAND (not of Ashmead), Berl. Ent. Zeitschrift 54 (1909) 210; CRAWFORD, Proc. Ent. Soc. Washington 19 (1918) 169.

Female (*type*).—Length, about 7 to nearly 9 millimeters; black, with the tubercles yellow; mandibles bright chestnut red, except at base; knees, tibiæ, and tarsi reddish yellow, or the anterior tibiæ light red with a yellow stripe, the middle and hind tibiæ and hind basitarsi each with a large dusky area; flagellum red beneath, and scape with a red basal spot; hair of head and thorax ochraceous, abundant on thorax, forming a fine down on mesothorax, conspicuous in certain lights, not in others, but sides of mesothorax with dense bands of tomentum, posteriorly extending narrowly in front of scutellum; mesothorax dull, it and the scutellum very minutely rugosely

punctate; area of metathorax rather large, dull, microscopically rugose, with a slight tendency to plication basally; tegulæ testaceous, with a yellow spot; wings hyaline, with pale ferruginous stigma and nervures; first recurrent nervure joining second submarginal cell some distance before its end; third submarginal cell much broader in middle than second; outer recurrent and transverse cubital weakened; posterior face of metathorax densely covered with hair; legs with pale ocherous hair; hind spur with four long slender spines and a fifth rounded rudiment; abdomen broad, moderately shining, with a sericeous surface; basal part of first segment with dense pale ocherous hair, and segments 2 to 4 with dense basal bands; ventral segments polished and shining basally.

Male.—Length, about 6.5 millimeters; clypeus with a broad yellow apical band; labrum yellow; mandibles broadly yellow in middle, but with a black spot at base; scape yellow in front; flagellum rather long; dark areas on tibiæ smaller, and hind basitarsi all yellow; hind margins of abdominal segments very narrowly fulvous; apical plate very broad and rounded; third ventral segment with a dense stiff brush of whitish hair along the margin, not reaching the sides.

LUZON, Laguna Province, Los Baños (*Baker*), type locality; Mount Maquiling (*Baker*); Pagsanhan (*Baker*), the male described and 2 females: Manila (*Eschscholtz*), type of *H. manilæ* Strand. MINDANAO, Cagayan (*Baker*); Dapitan (*Baker*).

A male from Mount Maquiling is *Baker 2560*. A very distinct species, on account of the color of the legs resembling *H. roepkei* Friese, from Java.

Halictus opisthochlorus sp. nov.

Female.—Length, nearly 7 millimeters; anterior wing, 4.75 millimeters; black, with the upper part of the metathorax dark blue-green; pubescence scanty, face with inconspicuous dark fuscous hairs, mesothorax almost bare, sides of thorax with thin white hair, abdomen without hair bands or patches, but with a scopa of long, white, curled hairs on ventral surface; head broad and short; antennæ black, scape reaching to level of ocelli; face and front dullish with a sericeous luster; mesothorax and scutellum dullish, with a sericeous luster and without evident punctures; area of metathorax with very fine striæ, appearing granular under a lens; posterior truncation not sharply defined; tegulæ brownish black; wings dusky hyaline, strongly iridescent; stigma and nervures piceous; second and

third submarginal cells about the same size, high and narrow, together smaller than first; first recurrent nervure meeting first transverse cubital; legs black, inner side of hind tarsi with bright ferruginous hair; hind spur pectinate; abdomen shining black, without evident punctures. The abdomen is like that of *H. melanurops*.

LUZON, Mountain Province, Baguio (*Baker*). This species and the next two show a general relationship to some of the Australian forms. On the other hand, *H. baguionis* Crawf. is related to the Formosan *H. perangulatus* Ckll.; so we have in the Philippines a meeting place of northern and southern groups of the genus.

Halictus caroli sp. nov.

Female.—Length, 6 millimeters; black, with broad abdomen; hair of head and thorax white, abundant at sides of thorax and long on clypeus; antennæ black, with basal half of scape red in front; inner orbits rather strongly concave; face and front dullish; mesothorax and scutellum dull, without evident punctures; area of metathorax dull and granular, a little shining at apex, where there is a median sulcus; tegulæ pale testaceous; wings faintly dusky, nervures and stigma piceous; second and third sumarginal cells high and narrow, about equal; first recurrent nervure joining second submarginal cell near end; legs black, small joints of tarsi ferruginous; abdomen black, shining, without bands or patches of tomentum; venter with a scopa of long curled hairs, tinged with ocherous at sides.

PALAWAN, Puerto Princesa; sent by Prof. C. F. Baker, after whom it is named.

Halictus mcgregori sp. nov.

Female.—Length, 7 millimeters; black, with broad abdomen; hair of head and thorax scanty, but dense and dull white on tubercles, and sides of metathorax with a conspicuous white fringe; head broad, clypeus short; antennæ black; supraclypeal area strongly convex; face and front moderately shining; mesothorax and scutellum dull, without evident punctures; area of metathorax large, entirely opaque, faintly striate at sides toward base; posterior truncation hairy; tegulæ ferruginous; wings dusky, nervures and stigma piceous; second and third submarginal cells high and narrow; first recurrent nervure meeting second transverse cubital; legs black, hind tibiæ and tarsi with black hair on outer side and fulvous on inner; hind spur with a few large teeth; abdomen dullish, without band or

patches of tomentum; venter with a scopa of long curled hairs and large patches of pale fulvous hair at sides of segments.

PANAY, Antique Province, Culasi (*McGregor*), type, June 3, 1918. LUZON, Laguna Province, Mount Maquiling (*Baker*), 1.

Halictus oligostictus sp. nov.

Female.—Length, nearly 8 millimeters; very robust; black, pubescence scanty, fringe of tubercles dense and tinged with ocherous; antennæ black, the flagellum faintly reddish apically; clypeus with large punctures; front dullish, finely punctured and substriate; mesothorax and scutellum dull, with large, widely scattered punctures, very few on scutellum; area of metathorax dull, with strong longitudinal plicæ; posterior truncation finely tomentose, sharply defined above and at sides; prothorax with prominent tubercular and anterolateral angles; tegulæ black; wings slightly dusky, stigma and nervures piceous; first recurrent nervure meeting second transverse cubital; third submarginal cell more than twice as long (broad) as second; legs black; hind tibiæ and tarsi with black hair on outer side and pale yellowish hair on inner; hind spur with a few large spines; abdomen very broad, shining black, without evident punctures; second segment with a narrow patch of dull white tomentum on each side basally; venter with pale hair, but no long curled scopa or lateral patches.

LUZON, Mount Banahao (*Baker*).

Halictus lionotulus sp. nov.

Female.—Length, about 5.5 millimeters; black, with rather narrow thorax; hair of head and thorax dull white, not abundant; face narrowed below; clypeus and supraclypeal area shining, sides of face with dense grayish white hair; flagellum obscurely brown beneath; mesothorax and scutellum polished and shining, without conspicuous punctures; area of metathorax dull, with fine plicæ, the rounded apical margin shining; posterior truncation very hairy; tegulæ bright fulvous; wings dusky, stigma and nervures dusky reddish brown, not dark; outer recurrent and transverse cubitals much weakened; type with only two submarginal cells, the second transverse cubital absent, but another female, evidently of the same species, has three submarginals, the third broader than the second, but not twice as broad (the male also has three submarginals); legs black or dark brown, with much white hair, that on hind tibiæ entirely white; hind basitarsi with white hair, but with an orange brush at apex; mesopleura polished and shining; abdomen

shining, without evident punctures, hind margins of segments rather narrowly hyaline; the cotype (but not the type) shows some pale tomentum at extreme bases of second and third segments; fifth segment covered with white hair; venter with stiff white hair, but no curled scopa or lateral patches.

Male.—Length, about 5 millimeters; slenderer, flagellum not elongated, clypeus all black.

LUZON, Mount Maquiling (*Baker*), 2 females and 1 male. The type is a female.

Halictus scintillans sp. nov.

Female.—Length, about 6 millimeters; like *H. lionotulus,* but larger, with the hind margins of the abdominal segments not hyaline, and the area of the metathorax without distinct striæ, except at the extreme base, where they are very delicate.

LUZON, Mount Banahao (*Baker*), 1. It is quite likely that additional material will prove this to be only a local race or variety of *H. lionotulus.*

Halictus scapalis sp. nov.

Male.—Length, about 8 millimeters; black, robust, having the general form and superficial appearance of *H. oligostictus;* head very large, face extremely broad; cheeks very broad; mandibles ferruginous, black at base and apex; face and front glistening, with short pale ocherous hair; labrum chestnut red, with a pair of prominent projecting tubercles; clypeus closely punctured, with a median smooth raised band; scape slender and curved, basal half red; a groove running between the posterior ocelli; mesothorax and scutellum polished and shining, the mesothorax with rather close delicate punctures, the scutellum very sparsely punctured; area of metathorax well defined, shining, its basal half with strong regular plicæ; thorax with pale ocherous hair; mesopleura dullish, finely lineolate; tegulæ reddish; wings slightly dusky; stigma rather small, dark reddish, nervures brown; first recurrent nervure joining second submarginal cell before its end; third submarginal cell very broad, much larger than second; outer nervures distinct; legs dark brown or nearly black, with pale ocherous hair, anterior knees red, tarsi ferruginous apically; abdomen broad, shining, first segment without evident punctures, second finely punctured; pale tomentum at sides of base of segments 2 to 4; apical plate reddish, very broad and rounded. Flagellum short and abdomen broad as in females.

LUZON, Mount Banaho (*Baker*). A remarkable species.

Halictus postlucens sp. nov.

Female.—Length, about 7 millimeters; black, with pale ocherous hair; head ordinary; face glistening, clypeus with a depression at apical middle; front dull, narrowly shining along orbits; antennæ black; scutellum with fuscous hair, postscutellum with pale tomentum; mesothorax and scutellum shining, sparsely and finely punctured; area of metathorax poorly defined, glistening, with feeble, raised lines, and apically distinct traces of transverse striæ; posterior truncation well defined, smooth and shining; tegulæ piceous, with a reddish spot; wings dusky, stigma and nervures dull reddish, not dark; first recurrent nervure joining basal corner of third submarginal cell; third submarginal cell considerably larger and broader than second, though second is fairly broad; legs black, with pale ocherous hair, tarsi reddened at apex; abdomen shining, without evident punctures; some pale tomentum at bases of second and following segments; venter with pale ocherous hair, not forming a long curled scopa or lateral patches.

LUZON, Mountain Province, Baguio (*Baker*).

Halictus fulvovittatus sp. nov.

Female.—Length, 6 to 6.3 millimeters; black, the hind margins of the abdominal segments broadly testaceous or pale golden, the bands shading into ferruginous along their anterior margins, the bands on first two segments broader in the middle than at the sides; hair of head and thorax white with a creamy tint, dense on upper border of prothorax laterally, on margins of tubercles, and on postscutellum, thin on face; head ordinary; mandibles dark red in middle; flagellum obscurely reddish beneath; middle of clypeus depressed and punctured; a shining line along anterior orbits; mesothorax and scutellum finely and rather closely punctured; area of metathorax finely but very distinctly striate on basal half; posterior truncation with long hair and without sharp margins; tegulæ bright fulvous; wings faintly dusky, nervures and stigma dilute reddish sepia; first recurrent nervure joining second submarginal cell near apex; third submarginal cell larger than second, but higher than broad; knees and small joints of tarsi ferruginous; hind tibiæ and tarsi dull reddish; hind spur with three stout teeth; abdomen broad, conspicuously thinly hairy, but without bands or patches of tomentum; venter with short hair, but no curled scopa or lateral patches.

LUZON, Laguna Province, Mount Maquiling (*Baker*), 2.

Halictus davaonis sp. nov.

Female.—Length, about 6.5 millimeters; black, differing from *H. fulvovittatus* thus: Head broader; area of metathorax with a double sculpture of exceedingly delicate striæ all over and coarse rugæ basally; legs black, with red knees; pale marginal tegumentary bands on abdomen much narrower, those on first two segments not enlarged in middle.

MINDANAO, Davao (*Baker*), 2. Closely related to the last, but surely a distinct species.

Halictus melanurops sp. nov.

Female.—Length, about 7 millimeters; black, with little hair; abdomen polished and shining, without bands or patches of tomentum; head broad; clypeus dull basally, apically shining and with large punctures; supraclypeal area dull; front dull, densely punctured; sides of vertex closely punctured; antennæ black; cheeks striate, with a large polished shining space on lower part; mesothorax and scutellum dullish, finely punctured, the punctures very irregular on scutellum; area of metathorax longitudinally plicate; posterior truncation shining, not sharply bounded at sides; mesopleura dull; tegulæ black; wings dusky, stigma and nervures brown; first recurrent nervure meeting second transverse cubital; third submarginal cell not much larger than second, both rather broad; legs black; hind tibiæ with fuscous hair on outer side and white hair on inner, hair on inner side of hind basitarsi white; abdomen with stiff hair on venter, but no curled scopa or lateral patches; along the apical margin of the covered portion on dorsal segments 2 to 4 is a very fine fringe of plumose white hairs, forming a very delicate line.

Male.—Very similar but smaller; clypeus all black; flagellum elongated and submoniliform, as in typical *Halictus* males; tarsi dark.

LUZON, Mount Banahao (*Baker*), 1 female, type: Nueva Vizcaya Province, Imugan (*Baker*), 1 female: Mountain Province, Baguio (*Baker*), 1 male.

THE SWARMING OF ANOPHELINE MOSQUITOES [1]

By Charles S. Banks

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The swarming of Culicidæ has been reported from all parts of the world where these insects are found. Almost every record of such swarming has to do with members of the subfamily Culicinæ, as far as it is possible to ascertain. W. W. Smith says [2] that in New Zealand "a train passed through a wall of mosquitoes three quarters of a mile in length, twenty feet high and eighteen inches thick" and that this swarm was composed of *Culex* (*Uranotænia*) *argyropus* Walk. J. W. Douglas reports [3] a similar occurrence in London, where for ten days hordes of members of the genus *Culex* swarmed over the neighborhood and appeared like smoke when it issues from chimneys. They rose in the air for 10 meters and continually danced up and down in the twilight stillness. Holiday [4] records a like phenomenon in which *Culicada nemorosa* Meig. (synonym *Culex detritus*) was the species. F. V. Theobald [5] gives an account of *Culex pipiens* L. on the Downs, near Wye, England, "dancing in little clouds where they were sheltered from the wind." Romolo Gessi Pascha [6] speaks of myriads of mosquitoes, which obscured the air at Meshra-el-Rek.

Accounts similar to these have come from every Arctic explorer; and persons who have returned from Juneau, Nome, and Skagway, as well as other parts of Alaska, and from northern Siberia including Kamchatka Peninsula, even north of the Arctic Circle, mention the immense swarms of mosquitoes that are to be encountered. It would seem from the reports that many of the swarms there were made up largely of females, which accords with my observations in northern New York in years gone by. The consensus seems to be that the swarms

[1] From the entomological laboratory, College of Agriculture, University of the Philippines, Los Baños.

[2] Ent. Mo. Mag. (1890) 321.

[3] Ibid. (1895) 239.

[4] The Entomologist 1 (1883) 151.

[5] Monograph of the Culicidæ of the World 1 (1901) 73.

[6] Seven Years in the Soudan (1892) 47.

seen in the warmer parts of the earth are largely composed of males.

No mention seems to have been made, in accounts dealing with mosquito swarming, of Anophelines performing this interesting act. Two years ago this month (in March, 1917) having had occasion to descend Faculty Hill at the college campus, at dusk, I encountered two or three distinct swarms of *Myzomyia rossii* Giles dancing in the air, at a height of about 2.5 meters above the roadway. Rapidly sweeping my hand through the swarm I caught a few specimens for the purpose of identification, as I did not observe at the time that they were Anophelines, not Culicines. A note of the occurrence was made, but no further observations were had and the matter was forgotten until March 4 of this year (1919) when, upon returning home from my laboratory at 6.25 in the evening I encountered four distinct swarms within 60 meters of my house, which stands on a rise of ground at the foot of Faculty Hill. These swarms were hovering at about 1.5 meters above the roadway; their music was quite audible, and they were flying against a wind having a velocity of 12 to 15 kilometers an hour, maintaining themselves without the slightest difficulty at any point desired (as, for instance, directly overhead) and following me as I passed through the swarm.

When my hand swept among them, in order to capture a few, the whole mass darted off to right or left, or up or down the road, with the greatest ease and with a decidedly concerted motion, returning when the disturbance ceased. Hastening to the house, I secured a net and returned to find that they were even closer to the ground than before, the base of the swarm being less than a meter from the roadway; but, as the entire swarm was dancing up and down, the individuals frequently rose to a height of 3 to 4 meters in the air.

With a couple of sweeps of the net, I caught one hundred twenty-seven individuals out of two of the swarms and I estimated that each swarm must have contained in the neighborhood of a thousand individuals.

On the evening of March 5 the same phenomenon was witnessed about 100 meters farther up the same road, at precisely the same hour. The road at this point was well shaded on both sides by several high trees. The swarms in this case were very much larger than those seen the previous evening. They extended higher into the air and seemed to dance with much more

vigor, the wind at that time blowing at only about 9 to 10 kilometers an hour. Out of these swarms seven hundred ninety-four mosquitoes were captured, all males, though sweeps were made at the edges of the swarms in the hope that females might be lurking on the outskirts. As night fell very rapidly, it was impossible on either of these occasions to ascertain the presence of females by observing a different character of flight between the two sexes.

It should be noted here that on the evening of the fifth a great number of females of this species was taken in the house at light, and they were also found in considerable abundance clustering and flying close to the nipa roof of the veranda, a favorite hiding place for Anophelines and a place where thousands of them must be captured nightly by a certain little spider, the habits of which are to be described elsewhere.

Further observations, made on the evening of March 6 at the same hour, revealed other interesting and important features of this swarming of Anophelines. Having stationed myself at 6.15 in the evening, at the upper part of the road nearly opposite the Forestry Station, I noticed some half dozen males of *M. rossii* flying swiftly up and down the road, about 1.5 meters above it. Within five minutes several hundreds had assembled, and within five minutes more there were many thousands, grouped roughly into three distinct clusters about 8 to 10 meters apart, each cluster connected with the others by numerous stragglers. Selecting a favorable spot, which would place the swarms between me and the sky, which was then of a pinkish blue, I waited to see what would occur.

At 6.30 the first female was seen to be caught by a male, and the pair flew slowly and obliquely upward and away from the swarm and was soon lost to sight. At intervals of about fifteen seconds other females were observed and this continued until 6.40; so that approximately fifty females were seen to enter the swarm and to be seized by males, each time the pair flying slowly but directly out of the swarm. Two pairs were seen to separate after about thirty seconds in copulation. At 6.45 the swarms had diminished more than half and at 6.50 only a few stragglers could be seen against the rapidly darkening sky.

Whether the mosquitoes came from the thick undergrowth at both sides of the road, as is probable, or whether they flew up or down the road, it is impossible to say; but the rapidity

of assembling and dispersing and the scant half hour during which the swarms were definite enough to be called such, might indicate a precise purpose and an exact time of the day for carrying out that purpose.

On this afternoon a very mild breeze was blowing, but there were occasional gusts which seemed to stimulate the mosquitoes to greater activity and to cause them to bunch together with a very quick movement, as players in a foot-ball scrimmage. If I stood perfectly still beneath a swarm, it came close to my head; if, on the other hand, I even gently thrust my hand upward, the Anophelines rose en masse away from it.

During the whole time of swarming, two dragon flies were darting in and out of the swarms, and each quite obviously caught a mosquito every time.

The two remarkable features of these occurrences are that the insects are Anophelines, and that they were swarming during a very stiff breeze on each occasion. Many observers, entomologists as well as non-entomologists, have maintained that high winds are inimical to the welfare of the mosquito, and that the insects will not venture forth when strong winds are blowing. It has been repeatedly stated that when mosquitoes are found at a distance from water, they have been wafted thither by gentle breezes. G. M. Giles, says:[7]

> * * * as naturalists are generally agreed that gnats cannot travel to any considerable distance, it follows that food both for adult and larva must be obtained within a limited area, for mosquitoes cannot and do not fly far. It is impossible to fix any absolute limit to their powers in this respect, but it may be safely asserted that few individuals ever stray much more than a quarter of a mile from the pool in which their larval youth was passed, and the great majority never travel further than the nearest shady spot. Nor, in spite of popular beliefs to the contrary, can they be carried far by the wind. Mosquitoes, indeed, exhibit a well-founded, instinctive dread of boisterous weather, and will not leave shelter in a high wind. Those accidentally carried away are, I am inclined to think, rapidly disabled.
>
> Another reason that makes it impossible for Mosquitoes to be carried overseas any considerable distance by the wind is that, whatever may be the rate of travel that they can bear without injury, the entire journey must be made at night, for in tropical regions shelter from the sun during the day is a matter of life and death to a Mosquito * * *.
>
> For these reasons, we may, I think reject, as having no foundation in fact, such popular beliefs as that the swarms of Mosquitoes that sometimes appear on the Persian coast, have been carried by the wind 200 miles across the Gulf from the Arabian shore; albeit you must be prepared to hear this belief quoted as an established fact, even by European residents.

[7] Gnats or Mosquitoes, ed. 2. London (1902) 112, 113.

I feel very safe in asserting that, from the observations made upon these anopheline mosquitoes in their action of flying against a stiff wind, we must certainly conclude that they have much greater power of flight than would be inferred from their apparently frail structure. If it be true that this species is so resistant to the wind—or rather, so capable of maintaining itself in safety in a high wind—what may not be expected of the more robust Culicines, such as *Culex fatigans* Wied., *Mansonia uniformis* Theob., *Stegomyia scutellaris* Walk., and one or two other species, the occurrence of which in a given locality can only be explained by the fact that they must have "come upon the wind?" If Anophelines, naturally more delicate in structure and with narrower wings and slenderer legs than those mentioned above, can fly against a 12-kilometer wind and maintain themselves at a given point, how much more easily could they or other mosquitoes be carried along by a wind, in which case they would simply be required to "give way" to its force and keep their balance!

The ready ease with which these insects evade the captor's hands and even his net would indicate that they possess in a very keen degree the percussion sense, that this would materially aid them in their windborne journeys in avoiding obstacles such as trees, and that they would find little or no incovenience in being wafted through wooded areas or around houses and other similar objects.

The ability to fly against the wind, together with their sense of smell, would make it possible for them at any time in their journey to "drop out" of the wind current in which they might be carried, and attack any animal or enter any house in their path. This is always on the assumption that females as well as males are at times addicted to the swarming habit, and that they too would manifest the same activities as those of the opposite sex. There is certainly nothing to refute such a hypothesis.

Many difficulties lie in the way of ascertaining precisely the minimum, or even optimum, distances which mosquitoes will fly; but it is certain that, at least in the Philippines, we must revise our ideas with respect to their being such frail creatures, not daring to venture forth except in a summer zephyr; and it is hoped that further observations along this line will enable us to say with greater certainty how far a mosquito can or will fly.

Molauin Creek, a rapid mountain stream, dividing the campus of the College of Agriculture, lies northwest by north of the point where the first swarms of Anopheline mosquitoes were seen. It is not more than 150 meters away, and is separated by a moderately thick grove containing many bamboos. The strong breeze mentioned is the daily tail end of the southeast monsoon of this time of the year in this locality; these facts might be adduced to show that neither the intervening woods nor the strong breezes would keep the mosquitoes from invading the college buildings as well as the houses higher up the hill, all of which lie to the windward of their breeding places.

Malaria is most prevalent in this locality during the dry season; the creek furnishes an ideal breeding place for *Myzomyia febrifera* Banks during the entire dry period, and the range of activities of this pernicious little mosquito would, if it have the same powers of flight as *M. rossii*, appear to be limited only by two factors, gamete carriers and the number of individuals exposed.

TWO PHILIPPINE LEAF-MINING BUPRESTIDS, ONE BEING NEW [1]

By Charles S. Banks

Professor of Entomology, University of the Philippines

THREE PLATES

Buprestidæ are metallic beetles the larvæ, or grubs, of which are called flat-headed, or hammer-headed, borers. They are usually wood borers, but Kellogg [2] states that the smaller species sometimes mine in leaves or live in galls. Comstock [3] says:

> In some of the smaller species the larvæ are cylindrical, and are furnished with three pairs of legs. These are leaf miners; and in the adult state the body is much shorter than in the more typical species.

It is true that the larvæ here under discussion are somewhat more cylindrical than is usual in this family, but there is absolutely no indication of legs, while the adults conform to the description given by Comstock. It may be that larvæ of Buprestidæ from other parts of the world are provided with legs, but Schiote [4] says of the buprestid larva *"pedes nulli,"* and his figures of the larva of *Trachys minuta* L. very strongly resemble those of this species, which is closely related.

The occurrence of these larvæ in leaf mines is so rare, however, that a note concerning two species may be of interest, especially as the insects attack a plant of some economic importance because of its use as an ornamental.

The two species under consideration are *Endelus bakeri* Kerrem.,[5] a small beetle not more than 4.5 millimeters in length and particularly noteworthy because of its prominent eyes, which are placed on conical, tubercular projections of the epicranium; and *E. calligraphus,* a new species.

[1] From the department of entomology, College of Agriculture, University of the Philippines, Los Baños.

[2] American Insects (American Nature Series) (1908) 266.

[3] Manual for the Study of Insects (1896) 549.

[4] De Metam. Eleuth. Øbs., Naturh. Tidsskr. 6 (1876) 361, pl. 2, figs. 18–22.

[5] Philip. Journ. Sci. § D 9 (1914) 88.

ENDELUS BAKERI KERREMANS

The larvæ of the first species were found by one of my students, Mr. F. Q. Otanes, in blotch mines, singly, on the leaves of the bird's-nest fern (*Asplenium nidus* L.) on January 27, 1918, and the adults emerged on February 25.

Since they were first brought to my attention I have succeeded in discovering all stages of the insect as well as the larvæ, the pupæ, and the adults of the parasites that attack them.

EGG

The egg is a very flat, broadly elliptical object, with obtusely rounded ends. It is 1.75 millimeters long and 1.09 millimeters wide, dark chestnut brown over its discal area and pale to white around its margins, which are slightly crenulate, the submarginal area having a crinkled or undulated surface preceded mediad by a series of broad, rectangular, radiate fascia more or less indistinct. Along the median line are four groups of black, imbricated, subspinose prominences and an area of brown striæ which, being in subparallel series, may represent the area of the micropyle (Plate I, fig. 6).

The egg is so firmly glued to the leaf that it remains long after the affected leaf has died and becomes completely desiccated, and it serves as an excellent index to the beginning of a mine, where the battered condition of the leaf might make its discovery otherwise difficult. It is almost invariably laid on the lower surface of the leaf (Plate III, fig. 1) although it has been found on the upper surface of leaves near the center of the plant or where very little space intervenes between successive leaves (Plate III, fig. 2).

LARVA

Length, 7.5 millimeters; greatest width, 1.8 millimeters; thickness, 0.9 to 1 millimeter. It is pale apple green, the head being ochraceous or pale buff and this color dilutes the pale green of prothorax and mesothorax. The anal segment is almost white, slightly tinged with buff. The body is shiny and very translucent, so that the body fats and internal organs are plainly visible. The head when at rest is retracted for four-fifths its length into the broad, lobate prothorax, and is regularly cordate in outline, with a very narrow, dark brown line around its anterior half. The frontal suture is dark, well defined, and bifurcate caudad. The trophi are ferruginous, the antennæ short, stout and pale, with a stout, blunt terminal spine mediad and a slender seta, eight times as long, ectad (Plate II, fig. 3).

The prothorax has the laterocephalic lobes strongly, roundly produced cephalad, their anterior margins being on a line with the tip of the mouth or a little beyond. Its integument is finely reticulate-punctate and its lateral and cephalic margins are sparsely white haired, especially the lobes.

The mesothorax is two-thirds the length of the prothorax and is minutely punctate, these two segments being consequently dull glabrous. All the segments of the body caudad of the prothorax are strongly lobed laterad, except the twelfth, thirteenth, and fourteenth, the last being spherical; the other two, evenly rounded laterad; and the penultimate, five-eighths as wide as the antepenultimate.

The caudal margins of the first to the sixth abdominal segments are one-third to one-half longer than the cephalic margins; hence the lateral lobes are obcordate in outline (Plate II, fig. 3) and the segmental incisions are very deep. At the base of each lateral lobe on the dorsum is a convex, lunate, longitudinal sulcus which, with its neighbors, roughly outlines the lateral limit of the abdominal segmental articulations.

On the ventrum the second to the eighth abdominal segments are provided with sublateral, circular pseudopodal papillæ, laterad of which appear sulci, as dorsad, but somewhat more profound (Plate II, fig. 4).

In the last instar and previous to cessation of feeding, the larva measures 10 millimeters in length and is more buff or very dark cream, darker on the thoracic segments. The scutum and sternum of the prothorax are sharply outlined and darker and more chitinized than the surrounding integument. The anal segment is obtusely bilobed caudad. The abdominal pseudopodal papillæ are more prominent and glabrously corrugated.

The movements of the larva are very sluggish, both in the mine and when removed therefrom, and it has the peculiar habit of switching its tail from side to side in the gallery, thus leaving behind a fine string of excreta in a broad zigzag chain (Plate I, figs. 1, 2, and 3).

PUPA

The pupa just after formation is 6 millimeters long and 2.25 millimeters wide, and is greenish cream-white, glabrous, and subcutaneously opaque. It follows very closely the general form of the adult except that its abdomen is narrower, with the segmental articulations constricted somewhat as in the

full-grown larva. It is quite devoid of hairs, cilia, spines, or roughened or chitinized areas of any kind. Its skin is microscopically shagreened.

ADULT

The description of the adult is translated from Kerremans's original.

Endelus bakeri sp. nov.

Of the group of *E. weyersi* Rits. and *modiglianii* Kerrem. related on account of the head and prolongation of the ocular tubes [cones] to *E. diabolicus* Kerrem., but differing from that species by the elytral impressions and by the general coloration.

Short, pentagonal, entirely more or less bright bronze above; beneath almost black.

Head wide, deeply excavated; eyes protruding very much ectad, emerging from short truncated tubes [cones]; the surface almost glossy and very lustrous. Pronotum very much wider than long, short and stout, truncated cephalad with the anterior angles sharp and projecting, the sides widely arched cephalad and sinuous caudad with the posterior angles obtuse; the middle of the disc with two wide transverse carinæ. Scutellum small, triangular. Elytra short, stout, protruding at the shoulders, sinuous along their sides, attenuated caudad, individually widely rounded at their apices and minutely denticulated; the surface wavy and unequal, with wide lateral and discal impressions which are rounded, except those along the suture, on each side of the apex, which are elongated. Beneath smoother and more shiny than the elytra.

Length 3.5–4; width 1.25–1.5 mm.

LUZON, Los Baños.

These beautiful little purplish bronze beetles are especially noticeable by reason of the prominent, almost stalked eyes and the consequent excavation of the front of the head. The elytral undulations add to the brilliancy of the metallic color of which the legs, especially the femora, partake in a marked degree (Plate II, figs. 1, 5, 7, 10).

They remain for a certain period within the pupal skin after having apparently acquired all adult characters, including hardening and brilliancy of the integument, and for a somewhat shorter period in the mine. They fly rapidly, alighting after brief flights and running quickly over the leaf. Their copulation has not been observed nor has the egg-laying process been noted.

MINES

The eggshell can always be found at the beginning of the mine, which for a distance of 12 to 15 millimeters is narrow, usually not over 2 millimeters in width, and follows the leaf veins. It may then turn at an obtuse angle, continue for 15

to 25 millimeters more, and spread out as a blotch covering nearly the entire space between midrib and margin (Plate I, fig. 2).

The tendency of the larva in mining is to proceed from the base to the apex of the leaf, but this is not the invariable course (Plate I, fig. 1). After it has made the main blotch mine, it invariably makes a second, very much smaller, chamber at a distance of from 10 to 15 millimeters, connected with the first by a gallery of an almost uniform width of 3 millimeters in nearly every instance. A third chamber may be made (Plate I, fig. 7), and even as many as four subsidiary chambers may be mined out by a single larva (Plate I, fig. 1) before it decides to pupate. It closes the entrance to this chamber by a lunate mass of compacted excrement (Plate I, figs. 2 and 3). Occasionally larvæ mining in opposite directions will cross each other's connecting galleries and continue in their determined direction.

The thin epidermis of the leaf soon dries and becomes torn, leaving very large, jagged, brown-bordered scars which detract from the beauty of this very ornamental plant.

FEEDING HABITS OF THE ADULT

The adults of *Endelus bakeri* feed on the upper sides of the leaves in a very peculiar manner. They first eat out an oval space, devouring all of the upper epidermis and the parenchyma, leaving the lower epidermis entire. When this oval space is about the size of the body of the insect, instead of continuing to feed from outside the space, it deliberately settles down in the center of the denuded spot and proceeds with its meal from the bare white space. It is difficult to see why it should feed in this very strange manner, because its dark body is much more conspicuous against the white spot than against the darker green of the leaf.

It will be seen by reference to Plate III, fig. 2, that the white spots are located near the apex of the leaf; but this is not always the case, although the majority of them are found on the apical half of it. When a beetle is feeding it is not easily frightened from its repast and the hottest sunshine does not seem to annoy the insect.

PARASITES

The larva of *Endelus bakeri* is parasitized by at least one species of chalcis fly, the female puncturing the epidermis of the leaf and laying her eggs through the dorsal skin of the

mesothoracic segment of the larva, leaving a black scar near its articulation with the prothorax. As many as eighteen punctures made by the ovipositor of the parasite were counted in the upper epidermis of a leaf over the fifth chamber of the larva. The larvæ of the parasite emerge from the pupa of the beetle and pupate around it, after the maner of many species of the Chalcididæ. The adults emerge through numerous circular punctures which they chew in the leaf epidermis. As many as twelve exuviæ of the parasite's pupæ have been counted around one beetle pupa carcass, and twelve adults were bred from one mine.

Adults of the parasite are tiny, metallic, purplish blue-green insects, with brownish black eyes and snow-white, black-tipped tarsi. The body is regularly ornamented with snow-white hairs, which are also found on the antennæ and legs. The length is about 1.25 millimeters.

It is believed that the larvæ are also attacked by a fungus disease, the disintegrated remains of several larvæ giving evidence of some such attack. Numerous mites of an undetermined species inhabit the leaf chamber, feeding on the débris left by the beetle larvæ.

INJURY BY THE BEETLE AND REMEDY FOR ITS ATTACK

It is rare to find more than three larvæ in a single leaf, but each larva can do much toward injuring the leaves and thus spoiling the general appearance of the fern. The most expeditious method of combating the pest is to examine each leaf for the incipient mine and its occupant and, when located, simply to kill the larva by squeezing the spot between thumb and finger.

The seasonal prevalence of the beetle is not known; but, from the appearance of a large number of ferns examined at the college, it is believed they do most of their damage in the period from December to March. One of my students states that the insect was abundant in July and August of 1917.

In examining bird's-nest ferns for further specimens of the blotch mine buprestid, *Endelus bakeri*, my attention was attracted to a short-leaved plant, perhaps another variety of *Asplenium nidus*, in which the mines were linear and very tortuous, as shown in Plate I, fig. 4. Specimens of these leaves, containing nearly full-grown larvæ, were kept in cages, and to my great delight two adults emerged which are entirely different from *E. bakeri*. The specimens, both of which are fe-

males, prove to be a new species which I propose to call *Endelus calligraphus* from the great resemblance of the mines to handwriting.

Leaf specimens thus far examined show the eggs as being laid almost invariably near the tips, the larvæ working toward the petiole and then crossing and recrossing their older galleries, often returning as close to the leaf tip as possible, but always going back down the midrib for pupation in a very slightly enlarged chamber at the end of the gallery near the leaf base. This entire gallery may be made in that portion of the blade lying on one side of the midrib (Plate I, fig. 5).

The larvæ succeed, with great skill, in keeping the gallery walls intact, as will be noticed, even when the turns lie very close together. But when they cross an old gallery it is usually at right angles and in a straight course. All the galleries, old and new, lie in the same plane, so there is no doubt that on crossing an old one they actually tap it and do not go above or below it as might be supposed. This is borne out by dissection of the leaf.

The life history of this species has not yet been worked out. It will be noted in the figures in Plate II that the dark spots shown along the central line of the gallery indicate the distribution of the pellets of excreta, or frass. Their arrangement is much more regular than is possible in a blotch mine, the growth of which is far less regular.

The total length of the gallery or mine shown in Plate I, fig. 5, is 89 centimeters, while the mine shown in Plate I, fig. 4, is 111 centimeters in length, the average being exactly 1 meter.

Endelus and allied genera of Buprestidæ, for example, *Aphanisticus* and *Trachys*, will probably be found to contain many species the larvæ of which are miners in the leaves of plants of the *Asplenium nidus* group and related genera of ferns.

A NEW BUPRESTID

Thus far but the two species of *Endelus* mentioned here have been recorded from the Philippines, but there are at least two other undescribed species in the college collection.

Endelus calligraphus sp. nov.

Entirely brown with uniform greenish bronze sheen over entire dorsum; head more brilliantly greenish bronze; ventrum a black bronze; legs similarly colored; eyes darker brown.

Head and pronotum microscopically reticulate and with

coarse, sparse, shallow punctures; elytra coarsely undulate-punctate. Ventral surface and legs smooth.

Head in dorsal view subglobose, front obtusely excavate (angle of 134°) (Plate II, figs. 2 and 12), frontal sulcus deep; eyes obtuse-ovate, occupying one-half the total width and three-fourths the length of head, in profile front strongly retreating so that trophi nearly touch prosternum; antennæ with segments 5 to 11 progressively acutely serrate, finely setose, segments 1 and 2 ovate, glabrous, 3 slender, 1 with few setæ, 2 and 3 bare; antennal groove somewhat sinuous (Plate II, fig. 6).

Pronotum two and one-half times as wide as long, cephalic margin feebly sinuous, except laterad where it projects cephalad with an acutely rounded angle, lateral margins obliquely arched and somewhat convergent caudad to form a slightly obtuse angle with caudal margin; caudal margin nearly straight, but with a curved submedial emargination to fit elytra; disk with two large, shallow, transverse, submedian sulci, separated by an area one-half their width, caudolateral area shallowly excavate, cephalolateral area less so and separated from former by an oblique elevation which is continued mediad to form caudal border of the transverse sulci described above; scutellum small, subequilaterally triangular, depressed mediad (Plate II, fig. 2).

Elytra very slightly wider than pronotum with sides parallel for a little more than five-eighths of their length, then evenly, roundly converging to their apices which are subsemicircular and with a few almost obsolete denticulations, humeral area with a prominent knob, apical area with a narrow, shallow obsolescent subsutural sulcus, each elytron with an obsolescent transverse depression at its first and second thirds; entire elytral area transversely confluently undulate, rugose or punctate-rugose.

Legs bronze-brown, brilliant, glabrous, basal halves of posterior femora fit into well-defined transverse pits in the sublateral portions of the metasternum; femora lenticulately flattened, with shallow, wide sulcus on apical area, between which and the body the tibia and the tarsus are hidden when at rest; tarsi with golden to pale yellow ventral pilosity.

Length, 3.65 millimeters; width at elytra, 1.50; length of head, 0.45; length of pronotum, 0.55; length of elytra, 2.65; length of scutellum, 0.25.

LUZON, Laguna, Los Baños, March 20, 1918 (*Banks*), two

bred specimens. Type No. 18397 in College of Agriculture collection, Los Baños.

This species approaches *Endelus marseulii* H. Deyr. in size; it differs from *E. æthiops* H. Deyr., which it closely resembles, in being bronzy brown, in the greater obliquity of the face, in the sides of the elytra being parallel for five-eighths of their length and lacking the strong impression and the large gibbosity at their bases.

The specific name is suggested by the galleries made by the larvæ in the leaves of *Asplenium* sp., which have the appearance of handwriting.

ILLUSTRATIONS

[Drawings and photographs by the author.]

PLATE I

FIG. 1. Five-chambered mine of *Endelus bakeri* Kerrem., in *Asplenium* leaf, showing crescentic mass of excreta used to close the entrance to chamber 5, and zigzag line of frass left by the larva.

2. Two-chambered mine of *Endelus bakeri*, showing two exit holes gnawed by an adult in emerging from the leaf.

3. Mine made in laboratory by *Endelus bakeri*, showing daily progress of a larva. Point 1 was reached two days after hatching; point 2, the next day; and so successively until one month thereafter point 12 was reached.

4. Leaf of *Asplenium* sp. with serpentine mine of *Endelus calligraphus* sp. nov., on both sides of the midrib. The total length of the mine is 111 centimeters. The dots represent excreta, and the enlarged chamber at the base of the leaf is the point of pupation, with the exit hole of the adult.

5. Leaf of *Asplenium* sp. with mine of *Endelus calligraphus* entirely on one side of the midrib. This mine was 89 centimeters long. Note the digression of the mine around a hole near the base of the leaf. Note also that the eggs were laid in these two leaves near the apex and the pupal chambers were made near the base.

6. Egg of *Endelus bakeri*, very greatly enlarged.

7. Unusual style of mine made by *Endelus bakeri*, in which the larva has turned back and excavated its pupal chamber near the point where the egg was laid.

PLATE II

FIG. 1. *Endelus bakeri* Kerrem., half outline of adult.

2. *Endelus calligraphus* sp. nov., half outline of adult.

3. *Endelus bakeri*, larva, dorsal aspect.

4. *Endelus bakeri*, larva, ventral aspect of abdomen.

5. *Endelus bakeri*, adult, profile of head and thorax.

6. *Endelus calligraphus*, adult, profile of head and thorax.

7. *Endelus bakeri*, adult, ventral aspect of head and thorax.

8. *Endelus calligraphus*, adult, ventral aspect of head and thorax.

9. *Endelus calligraphus*, adult, antenna.

10. *Endelus bakeri*, adult, antenna.

11. Diagram, showing facial angle of *Endelus bakeri*.

12. Diagram, showing facial angle of *Endelus calligraphus*.

PLATE III

FIG. 1. Leaf of *Asplenium nidus* L., showing eggs and blotch mines of *Endelus bakeri*.

2. Leaf of *Asplenium nidus* L., showing, in addition to mines, white spots caused by feeding of adult beetles of *Endelus bakeri*.

PLATE I. EGG AND MINES OF ENDELUS SPECIES.

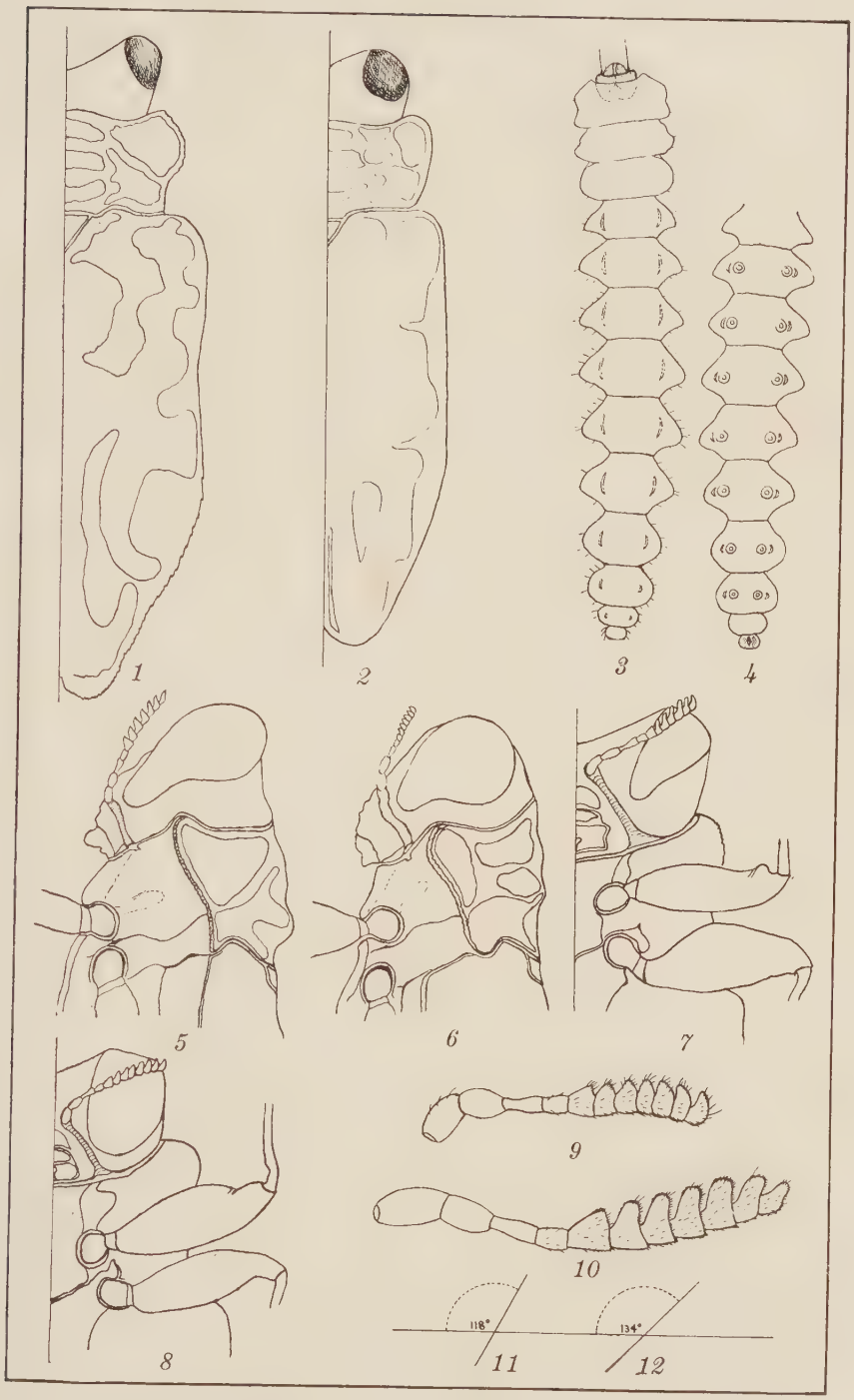

PLATE II. ENDELUS BAKERI AND E. CALLIGRAPHUS.

PLATE III. LEAVES OF ASPLENIUM NIDUS L., SHOWING MINES OF ENDELUS BAKERI.

NOTICES OF CERTAIN FULGOROIDEA, II: THE GENUS TROBOLOPHYA

By C. F. Baker

Of the College of Agriculture, Los Baños

SIX TEXT FIGURES

In 1913, Melichar[1] described a new genus, *Trobolophya*, of the family Dictyopharidæ, based upon a single specimen collected in Java by Jacobson. Just before this I had sent to Melichar a Philippine representative of the same genus, which he referred to as being the same as the Javan species.[2] After 1913 I discovered that this genus is widely and commonly distributed in the Philippines in several species, and that it occurs in western Malaysia as far north as Penang Island, Straits Settlements. In making a careful study of the accumulated material, it appears that the Javan species is quite distinct from any known Philippine form.

It is hard to explain why so generally distributed a genus, with some of the species very common, remained unknown to science until 1913, unless it be due to the fact that the species are montane and arboreal; though this is only in so far as my experience goes.

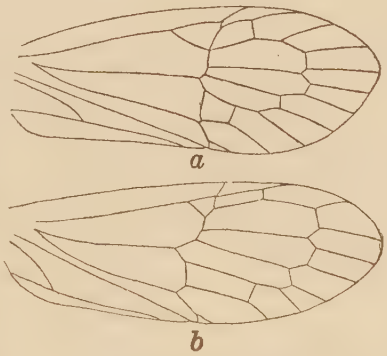

Fig. 1. *a*, *Trobolophya philippinensis* sp. nov., tegmen; *b*, *T. melichari* sp. nov., tegmen.

External anatomical features in this genus are difficult to appraise at their true comparative value since, as in many Derbidæ and other fulgorids, high and thin margins may incline one way or the other in drying, and partial collapse of certain areas may occur. It is thus very important to have ample series of specimens for study, and in most cases I have obtained these. The genitalia will, as in other Fulgoroidea, undoubtedly furnish characters of great diagnostic value, but in this case would require dissection and special preparation

[1] Notes Leyden Mus. 36 (1913) 92. [2] Loc. cit.

which would be a considerable undertaking in itself. The species so far recognized may be separated as follows:

Synopsis of the species of Trobolophya.

a^1. Intraocular portion of vertex, on median line, less than one-third length of anteocular; viewed from side, lateral margin of vertex highly arched at base; outer anteapical cell long and narrow, inner anteapical three times as long as broad (fig. 1, *b*) tegmina transversely banded..... melichari sp. nov.

a^2. Intraocular portion of vertex, on median line, about as long as anteocular; viewed from side, lateral margin of vertex not so highly arched at base; outer anteapical cell broad, inner little longer than broad (fig. 1, *a*); tegmina never transversely banded.

b^1. Angle between lateral margins of vertex and front, as viewed from side, more than a right angle, and with the black spot roundish, not reaching eye.

c^1. Clypeus, in side view, strongly raised above the level of the front. penangensis sp. nov.

c^2. Clypeus, in side view, not or very little raised above level of front.

d^1. Lateral spot of vertex large; veins of tegmina fuscopiceous. jacobsoni Mel.

d^2. Lateral spot of vertex small; veins of tegmina piceous black. montana sp. nov.

b^2. Angle between lateral margins of vertex and front, as viewed from side, a right angle or less, and with the black spot in the form of a large band, narrowing eyeward, and nearly or quite reaching eye.

c^1. Vertex about as long as broad at base; smaller, paler species with dark fuscous veins..... philippinensis sp. nov.

c^2. Vertex distinctly longer than broad at base; larger, dark green species with piceous black veins..... benguetensis sp. nov.

Trobolophya melichari sp. nov.. Fig. 2, *a*, *b*.[3]

Female.—Length, 5 millimeters. Pale greenish, legs stramineous, becoming entirely stramineous with a darker scutellum in drying. The lateral black marks on head show through on vertex as two parallel lateral lines on apical half and as black spots at basal angles. Tegmina hyaline, veins fuscous; a narrow, irregular, curved, smoky band passes from stigma to near apex of clavus.

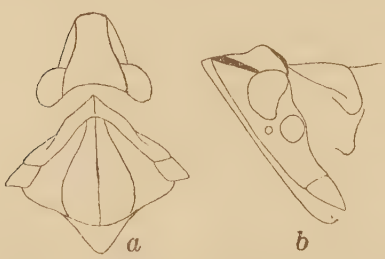

FIG. 2. *Trobolophya melichari* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, side view.

LUZON, Laguna Province, Mount Maquiling: Tayabas Province, Malinao. MINDANAO, Davao (coll. *Baker*). Differs from

[3] Characters given in the synopsis are not repeated in the following descriptions.

all other known species of the genus in form of head, venation, and coloration, and constitutes a distinct section of the genus. Named for Dr. L. Melichar, the founder of the genus.

Trobolophya penangensis sp. nov. Fig. 3, *a, b.*

Female.—Length, 6 millimeters. Head and legs stramineous, thorax sanguineous, abdomen pale green; lateral spots of head scarcely showing through on vertex; anterior tibiæ with outer border piceous. Tegmina hyaline, veins fuscous.

Penang Island, Straits Settlements (coll. *Baker*). Near to *T. jacobsoni* but distinct in form of clypeus and in coloration.

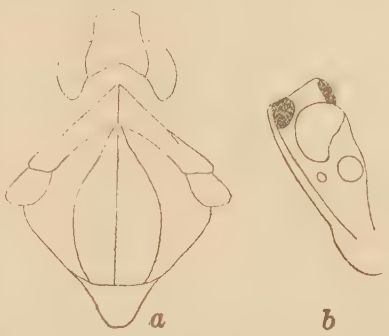

FIG. 3. *Trobolophya penangensis* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, side view.

Trobolophya jacobsoni Mel.

Melichar's detail drawings (pl. 3, fig. 1, 1*c*) are very diagrammatic. For instance, the drawing shows the lateral margins of vertex parallel throughout, which is not true for any species of the genus. Also, the position of submedian keels of scutellum are never as shown. Melichar does not mention, or show in his drawing, that the narrow caudal appendage of scutellum is separated by a distinct transverse carina connecting the posterolateral margins of scutellum; the caudal moiety is more or less concave and possibly represents a postscutellum. The vertex is nearly as long as broad, if the length is measured on the median line only; but Melichar evidently measured it at the side, or length over all, since he says "vertex once and a half as long as wide at base."

Trobolophya montana sp. nov. Fig. 4, *a, b.*

Female.—Length, 7 millimeters. Body deep green, head and legs stramineous; frontal and scutellar carinæ and outer margins of fore tibiæ piceous; spots on sides of head scarcely showing through on vertex. Tegmina hyaline or slightly milky clouded, longitudinal veins piceous, costa and cross veins pale fuscous.

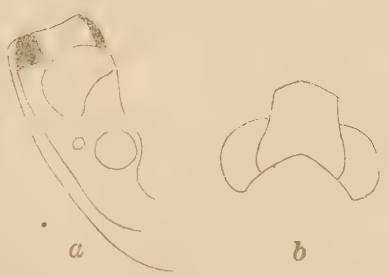

FIG. 4. *Trobolophya montana* sp. nov.; *a*, head, side view; *b*, vertex.

Male.—Length, 6 millimeters. Coloring paler.

LUZON, Nueva Vizcaya Province, Imugan (coll. *Baker*),

abundant. A slightly smaller, paler form is abundant on Mount Banahao, Laguna, Luzon; this form has also been encountered at Malinao, Tayabas, Luzon.

Trobolophya philippinensis sp. nov. Fig. 5, *a, b.*

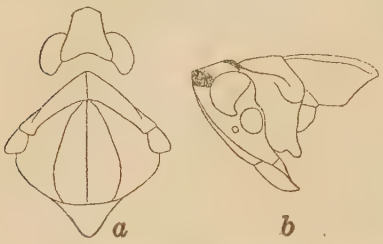

FIG. 5. *Trobolophya philippinensis* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, pronotum, and scutellum, side view.

Female.—Length, 5.5 millimeters. Pale green, head and legs stramineous; frontal and scutellar carinæ and outer margins of fore tibiæ fuscous; spots on sides of head showing through as small spots on vertex at outer anterior angles. Tegmina hyaline; longitudinal veins dark fuscous, darker basally and on clavus, cross veins and costa paler.

Male.—Length, 5 millimeters. Color paler.

LUZON, Laguna Province, Mount Maquiling and Mount Banahao (coll. *Baker*), common. A smaller, paler form occurs in the mountains of Benguet and Nueva Vizcaya. It is noteworthy that in the case of *T. montana,* a larger, deeper green form occurs in the northern mountains, and a smaller, paler form, on Maquiling and Banahao; while in the present species just the opposite is the case. This species is the one formerly referred to *T. jacobsoni* by Melichar.

Trobolophya benguetensis sp. nov. Fig. 6, *a, b.*

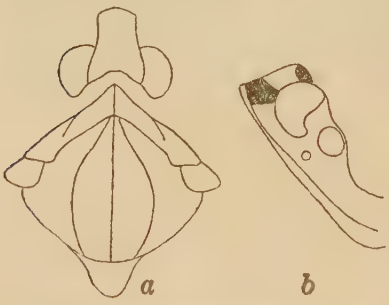

FIG. 6. *Trobolophya benguetensis* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, side view.

Female.—Length, 7 millimeters. Body, including head, deep green, sometimes with sanguineous tinting between scutellar carinæ; facial and scutellar carinæ concolorous; outer margin of fore tibiæ piceous. Lateral spots of head showing through as narrow black marks on vertex at anterolateral angles. Tegmina hyaline, stigma stramineous; veins, except costa, all piceous-black, darker basally.

LUZON, Benguet Province, Baguio: Nueva Vizcaya Province, Imugan (coll. *Baker*). This species might be readily confused with *T. montana* on superficial examination, as the two are of similar size; but they can be readily distinguished by the different form of head and by the markings.

ILLUSTRATIONS

TEXT FIGURES

FIG. 1. *a*, *Trobolophya philippinensis* sp. nov., tegmen; *b*, *T. melichari* sp. nov., tegmen.
2. *Trobolophya melichari* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, side view.
3. *Trobolophya penangensis* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, side view.
4. *Trobolophya montana* sp. nov.; *a*, head, side view; *b*, vertex.
5. *Trobolophya philippinensis* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, pronotum, and scutellum, side view.
6. *Trobolophya benguetensis* sp. nov.; *a*, vertex, pronotum, and scutellum; *b*, head, side view.

SOY-SAUCE MANUFACTURING IN KWANGTUNG, CHINA[1]

By Elizabeth H. Groff

Of Canton, China

SEVEN PLATES

After a Chinese provides himself with rice, a little meat, and some vegetables, nothing is probably more important to him than the sauces which he eats with his food. In the book of Chau Lai (周 禮),[2] the ceremonial rites of the Chau Dynasty (周 朝), written before 1000 B. C., we read that the king's cook used one hundred twenty jars of sauces. Thus the written records of the Chinese show that they have been using these sauces for over three thousand years.

Soy sauce, known among the Chinese as *Ch'au yau* (抽 油), "drawing oil," or *pāk yau* (白 油), "white oil," is without question the best liked and most widely used. Kwangtung Province is famous all over China for the soy sauce which it produces. Canton as its capital is naturally the center of all this trade. Wholesale shops can be found in great numbers, and practically every food shop sells soy sauce. Each neighborhood also has its peddler who goes from door to door selling soy and other sauces. In Canton, jars of soy can always be seen in the making, as much of it is placed on the roofs to sun.

Sainam (西 南), "southwest," a city of about 30,000 inhabitants, 50 miles southwest of Canton on the Samshui (水 三), "Three Waters," Railway, is famous for the excellent quality of soy that it produces. The first-class shops in Canton all have signs advertising Sainam *Ch'au yau* (西 南 抽 油), "Sainam soy sauce," although most of this soy is made locally in their own establishments.

The process of securing information on the making of soy sauce is lengthy and difficult, and accurate data can only be obtained after months of experiment carried on with the help of a workman who has grown up in one of these establishments.

[1] All Chinese characters in the Cantonese are romanized according to the Eitel-Genaho Dictionary, but some of the diacritical marks are omitted.

[2] Chau Lai is one of the thirteen classics of Confucius.

Frequently a soy-sauce manufacturer will smile at the questions asked him and answer: "We pay workmen to tell us those things. Why don't you do the same?"

The methods of approaching Chinese with regard to the process of manufacture are intricate. Unlimited time, knowledge of Chinese customs, and courtesy are all important factors to success. It is often necessary to work through three or four Chinese before the man can be secured who will properly introduce one to the manufacturer from whom accurate data are to be obtained. Many hours of friendly chatting over tea and cakes must be spent with these men before the business in hand can be approached. But when the final introduction takes place, one is treated as an old friend and every courtesy is tendered.

The manager of a large sauce-manufacturing plant, On Shing Lung (安盛隆), at "West Gate" (西門) Sai Mun, was approached with this method. He has given full access to his books, allowed his head workmen to spend hours talking and answering questions, and has shown a keen interest in the investigations.

THE EQUIPMENT OF A SOY BEAN MANUFACTURING PLANT

Grounds and buildings.—The equipment in the largest establishments is very meager and differs from the small establishments only in capacity. In the average factory about one-third of the ground is covered with one-story buildings, which are usually built of gray brick and roofed with Canton tile. They are divided into storerooms, boiling shed, workmen's quarters, and mold room. The buildings usually surround the four sides of the plot, with a large court in the center for the sunning of the soy sauce.

Boiling shed.—The shed in which the beans are boiled is large enough to store sufficient raw materials for one boiling and for the board on which the beans and flour are mixed. The iron pan *t'it wok* (鐵鑊), in which the beans are boiled is semi-spherical, varies in size and price, and is sold by weight at about 14 dollars local silver [3] for 100 catties.[4] A pan large enough to boil 700 catties of beans can be purchased for about 100 dollars local silver. Its diameter is 52 inches, and its depth

[3] Local silver, at the present rate (1918), is worth about 1.05 dollars for 1 dollar Hongkong currency; 1.30 dollars Hongkong currency are worth 1 dollar United States gold.

[4] One catty is equal to one and one-third pounds.

is 32 inches. The brick oven constructed around this pan costs about 100 dollars local silver additional (Plate I).

Mold room.—The mold room is usually placed to the north so that the doors which control the light and ventilation, very essential to good mold, can be opened to the south and plenty of sunlight allowed to enter. This room can be made almost completely dark by the closing of these doors. It contains wooden racks on which the trays of beans and flour are placed to mold (Plate II, fig. 1).

Jars.—Brown earthenware cylindrical jars known as Shiuhing *kong* (肇慶缸)—now no longer manufactured—are the ones preferably used to sun the beans, salt, and water (Plate V, fig. 2). The Tsinguen *kong* (清遠缸), a brown earthenware jar of inferior quality but with the same contour as the Shiuhing jar, is now the only jar obtainable on the market. These jars are so named because they are manufactured in Shiuhing and Tsinguen, cities of Kwangtung. The Tsinguen jar leaks very easily, and the manufacturers prefer repaired Shiuhing jars to this inferior Tsinguen jar. The latter jar, 19.5 inches in diameter and 18.5 inches deep, with a capacity of 180 catties, can be purchased for 1.70 dollars local silver. About one thousand of these jars are kept in the sunning yard at one time, although at times only about two-thirds of them are in use. The Chinese believe that the jars are greatly improved by long sunning, and when space permits the jars are allowed to sun in the court yard for months at a time.

Racks.—The mold room is filled with crudely constructed wooden racks with horizontal partitions every 5 inches, on which are placed the trays of beans for molding (Plate II, fig. 2).

Trays.—Two types of trays are used, the commonest being the circular bamboo tray, *wo* (篼), made in Canton (Plate VII, fig. 1). This tray can be purchased in any size, but the most commonly used for soy making is about 3 feet in diameter with a rim of 1.5 inches. This tray is in general use in Canton for the making of many different sauces and the drying of vegetables. In order to save space many manufacturers construct light wooden frames with horizontal strips of bamboo placed close enough to support a very inferior quality of matting (Plate IV, fig. 1). These trays are made so as to fit the racks snugly. They are usually about 5 feet 2 inches long and 3 feet 9 inches wide. The matting for this size of tray can be purchased for 60 cents local silver. This seems to be an excellent method, for the matting can be replaced when worn out.

Baskets.—The bamboo baskets, *lo* (籮), used to drain the beans after they are boiled are round at the top and narrow toward the bottom, which is flat and more square than round. Various sizes can be purchased, but the commonest are 15 inches deep. They cost about 65 cents local silver each (Plate IV, fig. 2).

Covers.—Nothing is more important than a good cover with which to protect the sauce at night and when it rains (Plate V, fig. 1). A standard conical bamboo cover, 21 inches in diameter and 12 inches high, is used. These fit snugly over the top of the cylindrical jars and can be purchased for 35 cents each. This cover is called *tsim teng chuk lap* (尖頂竹笠), "pointed top bamboo."

Raw materials.—The raw materials used in the making of soy sauce are soy beans (Plate VI, fig. 1), flour, salt, and water. All of these are available in great quantity on the Canton market. The *wong kam tau* (黃金豆), "yellow bean," grown in Manchuria and known as coming from Ngau Chong (牛莊), is recognized as the best variety of soy bean to be used. This bean is yellow and is slightly smaller than the American soup bean; the outside coat is thick and tough and does not break apart easily after the bean is boiled. The Chinese consider this characteristic to be very important, for they wish to keep the bean as much intact as possible for the molding process. *T'o fui min* (土灰麵), local third wheat flour," comes from Kwangtung. The *shaang im* (生鹽), "raw salt," comes from Tientsin.

Method of mixing.—Soy sauce can be made in almost any quantity, but the beans mold much better and faster in large quantities. It is very difficult to obtain figures on the amounts of materials that are used. Each maker will tell you that he fills his iron sauce pan with beans and buys sufficient flour to mix with it and adds the salt solution at the proper time. In order to secure satisfactory data on the quantity of material used, it is necessary to be present when each process takes place.

Boiling of beans.—One Canton manufacturer [5] purchases 1,400 catties of beans at one time, dividing them into two boilings. This amount of beans, together with 1,200 catties of flour, provides sufficient molded beans to stock thirty-six jars. The beans are placed in a large iron pan (Plate I) and covered with about 1,100 catties of water. They are then boiled until soft. Care must be taken that the outside coat does not break.

[5] The establishment referred to on page 308.

The length of time required to soften the beans depends entirely upon the amount of heat applied. Another satisfactory process is to drop the beans into boiling water. The makers use both methods. If the beans are boiled constantly, three to four hours are sufficient for the softening process. However, in order to save time, many of the shops boil the beans at night, allowing the fire to die out and then removing the beans at about 4 o'clock in the morning. They are then placed in bamboo baskets, allowed to drain, and become almost cold before being mixed with the flour (Plate IV, fig. 2).

Mixing of beans and flour.—The beans are then poured upon the mixing board, two baskets at a time. Two men stand, one on either side of the board, and thoroughly mix the beans and flour with their hands. Care must be taken that each bean is covered with flour. This mixture of flour and beans is then placed on the trays to a thickness of about 1.5 inches, and the hand is used to furrow them so that they get proper ventilation (Plate II, fig. 2). The mixture remains in the mold room from one to two weeks, depending entirely upon the time of year and the weather. Much less time is needed in the hot rainy season. After the middle of November the manufacturing plants stop boiling beans and do not begin again until the spring season opens in February, as the weather during this period is unfavorable to produce the mold. After the beans are placed on the trays, they begin to mold in about three days.

Mold.—The natural yellow mold is probably a species of *Aspergillus*, and the undesirable black is a *Mucor*.[6] Care must be taken that only the yellow mold is used in the making of soy, and all black mold should be removed before placing in the jars of salt water (Plate VI, fig. 2).

Method of sunning beans and flour.—The mold from 1,400 catties of beans and 1,200 catties of flour is divided into thirty-six jars. A salt solution, of 150 catties of water to 40 catties of salt, is then poured into the jars until they are full. The salt solution is thoroughly cleaned before using by allowing the dirt to settle and then pouring off the solution. The jars of bean-flour mold and salt water are then placed in the yard to sun where they remain from two to six months (Plate V, fig. 2). The longer the period of time the better. Most of the shops,

[6] These general determinations were made by Prof. C. W. Howard, biologist at the Canton Christian College, who is making cultures for further study.

however, make the first drawing in from three to four months. At night or when it rains, the jars must be covered with bamboo covers. This sunning process results in an evaporation of the liquid in the jars; and three days before the drawing off of the soy, salt solution is used again to fill the jars. The first drawing is then made by siphon, *kwo kong lung* (過缸嚨) (Plate III, fig. 1). About 60 catties of the liquid are drawn off. This liquid is allowed to settle and is again drawn off, reducing the quantity to about 50 catties. It is then placed in clean jars and allowed to sun again for from one to six months. Some of this soy is at times allowed to sun for three years, but this is too expensive and is rarely done commercially.

First drawing.—This soy is called *teng ch'au* (頂抽), "first drawing." The material that remains in the jar is called *teng shi* (頂鼓), "first salted," and is sold as a separate sauce, used as the base of a number of different sauces or as the base for the "second drawing," *i ch'au* (二抽).

Second drawing.—A salt solution of 150 catties of water and 30 catties of salt is now poured on the *teng shi,* or the beans which remain in the jar from the first drawing. The jars are again placed in the sun for from one to two months. Salt water is again added three days before the drawing, after which the soy is drawn off, about 50 catties, after it is cleaned, and placed in the sun from one to two months. This is called *i ch'au* (二抽), "second drawing." The material which remains in the jar is called *ün shi* (原鼓), "beginning salted," and is sold as a sauce for 4 cents per catty, used as the base of a number of other sauces and as the base for *sām ch'au* (三抽), "third drawing."

Third drawing.—The same method is used in the making of *sām ch'au* as in *i ch'au* and the material which remains is called *chung shi* (中鼓), "middle salted." This is sold as a sauce at 2 cents per catty, used as the base of a number of different sauces and as the base for *sz ch'au* (四抽), fourth drawing."

Fourth drawing.—This is made the same as *i ch'au, sām ch'au,* and *sz ch'au,* and the material left in the jars is also called *chung shi* (中鼓) and is sold as a sauce at 1 cent per catty; it is used as the base of a number of very cheap sauces.

Boiling method.—The sunning method takes so much time that many of the manufacturers boil the second, third, and fourth drawings instead of sunning them. This makes a decidedly

inferior quality of soy, but it can be sold very cheaply. After the soy is drawn from the beans, it is placed in an iron pan and boiled from two to four hours. The longer the better, but it must be boiled at the least two hours or it will not keep. It is then taken off and allowed to cool and is ready for salt. The manufacturers never boil the first drawing. They always sun this and sell it for their finest grade.

Mixing of soy.—It is interesting to note that of the four drawings of soy the only drawing that is sold as it is drawn is the *teng ch'au* (頂 抽), "first drawing." The others are all mixed together and are sold under the names of the price they cost per catty. This mixing process is shown in the list of samples submitted.

Prices of raw materials.—The prices of beans and flour vary considerably, but the soy beans, *wong kam tau* (黃 金 豆), can be bought for about 6 cents per catty wholesale; the flour, *t'o fui min* (土 灰 麵), for about 6.5 cents per catty; and the salt, *shāng im* (生 鹽), for about 4 cents per catty. The retail price is 8 cents per catty for the beans, 10 cents per catty for the flour, and 5 cents per catty for the salt. The manufacturers figure that the materials for one jar cost about 8.50 dollars. They expect to sell the different grades of soy and the beans left for about 14 dollars. This does not include labor, equipment, rent, etc. Candied molasses, *kat shui* (桔 水), which is added to the very cheapest soy as a coloring and to sweeten it, costs about 8 cents per catty.

Sainam soy.—Sainam, 50 miles distant from Canton on the Samshui Railway, is famous for its soy. The establishments there are much larger than in Canton, and a superior quality of soy is produced. There are eight factories, all of about the same capacity, doing a business of over 100,000 dollars a year. The methods used in Sainam appear to be the same as those used in Canton, the only noticeable difference being in the quality of materials used. The Sainam soy makers advise buying the very best quality of raw materials, while the Canton manufacturers are content with materials of inferior grade. They believe that these inferior materials make just as good soy. The yards in Sainam also are very spacious, allowing the manufacturers to sun their product to better advantage. Ground is much less costly, and hence the sunning process is not so expensive. In one yard it was also noted that there were about five hundred jars not in use which were being sunned. Both

Canton and Sainam makers believe it is an excellent plan to sun jars. Limited space in Canton makes this impossible except on a small scale.

Making soy from rice.—Many of the village people make their own soy from the rice that has stuck to the bottom of the vessel in which it is boiled. A handful of rice is pressed into a ball and sprinkled with hot water. These balls are placed in a covered jar and allowed to mold. In about two weeks these balls are placed in salt solution, using one part of salt to five of water. Two parts of rice are used to three parts of salt solution. The more rice used the stronger the sauce will be. This is then sunned as the regular soy and produces a very inferior grade of rice soy, which is used by the poorer classes of Chinese as a substitute for the soy-bean sauce.

Soy samples and prices gathered on the Canton market.—There is no soy standard, but the different grades of soy are known in most of the shops as follows:

T' in teng ch'au yau (天頂抽油), "best selected drawn oil." Retailed at 40 cents local silver per catty. Made of *teng ch'au* (頂抽), "first drawing," which has been sunned four months after "drawing off."

Tsin pat ch'au yau (錢八抽油), "fourteen cents per catty drawing oil." This is made of the "first drawing" which has been sunned two months after "drawing off."

Kau luk ch'au yau (九六抽油), "eleven cents per catty *ch'au yau.*" Made of 50 per cent of the "first drawing" and 50 per cent of the "second drawing."

Sz pat ch'au yau (西八抽油), "eight cents per catty drawing oil." Made of 25 per cent each of "first drawing," "second drawing," "third drawing," and "fourth drawing."

Sam luk chung ch'au (三六抽油), "six cents per catty middle drawing." Made of 50 per cent salt solution, 50 per cent "third drawing" and "fourth drawing," and colored with candied molasses, *kat shui.*

Sheung pāk yau (上白油), "upper white oil." This is sold at 4 cents per catty and is made of 50 per cent salt and water and 50 per cent *sz ch'au,* "fourth drawing," and colored and sweetened with candied molasses, *kat shui.*

Pāt sin shāng ch'au (八仙生抽), "eight cents raw drawing." This is made of equal parts of "first drawing" and "second drawing," but after it has been drawn off the beans it is not boiled or sunned. This soy is used for soup and does not keep longer than about a week.

ILLUSTRATIONS

Plate I

The iron pan in which the soy beans for the making of soy sauce are boiled is used extensively in all sauce-manufacturing establishments; it varies greatly in size and is sold by weight. Note the bamboo basket fastened to a bamboo pole, by which the beans are removed from the pan.

Plate II

Fig. 1. The dark room in which the beans and flour used in the making of soy sauce are allowed to mold. The light and the ventilation, very essential to good mold, are controlled by doors, which open to the south. Trays of beans and flour now in the process of molding. The man in the picture is the head soy maker in this establishment.

2. The beans and flour, used in the making of soy, are thoroughly mixed and placed in rudely constructed wooden racks in the dark room for the molding process.

Plate III

Fig. 1. Soy sauce being drawn from the beans by means of a siphon. Great care must be taken not to stir the beans. The material which remains in the jar is called *teng shi*, and is sold as a separate sauce or is used as the base of the second drawing of soy.

2. The first drawing of soy, *t'in teng chau yau*, which is placed in clean jars and again sunned from two to six months.

Plate IV

Fig. 1. This light wooden frame, with horizontal strips of bamboo placed close enough to support the matting on which the soy beans and flour are placed for molding, is frequently used in place of the circular bamboo tray in order to conserve space.

2. The bamboo baskets, in which the boiled soy beans are placed to cool and drain, are round at the top and narrower toward the bottom, which is flat and almost square.

Plate V

Fig. 1. The conical bamboo covers, which are used to protect the jars at night and when it rains.

2. Rows of the standard-sized soy-sauce jars filled with the molded beans and flour and salt water. These remain in this position from two to six months. Note the conical bamboo covers in position for the quick covering of the jars in case of rain.

PLATE VI

FIG. 1. The soy beans shown here are natural size; they are yellow and have a thick outer coat. Great care is taken that the beans do not become mashed.

2. Beans and flour, which have been in the mold room for five days. The natural yellow mold is probably a species of *Aspergillus*, and the undesirable black mold is *Mucor*.

PLATE VII

FIG. 1. The circular bamboo tray that is commonly used in the making of soy and many other sauces and in drying vegetables. The trays have been stacked and are ready for removal to a storage shed.

2. Soy sauce ready for shipment to northern China. It is placed in sealed earthenware jars, which are incased in bamboo holders.

PLATE I. THE IRON PAN IN WHICH THE SOY BEANS ARE BOILED.

Fig. 1. The dark room.

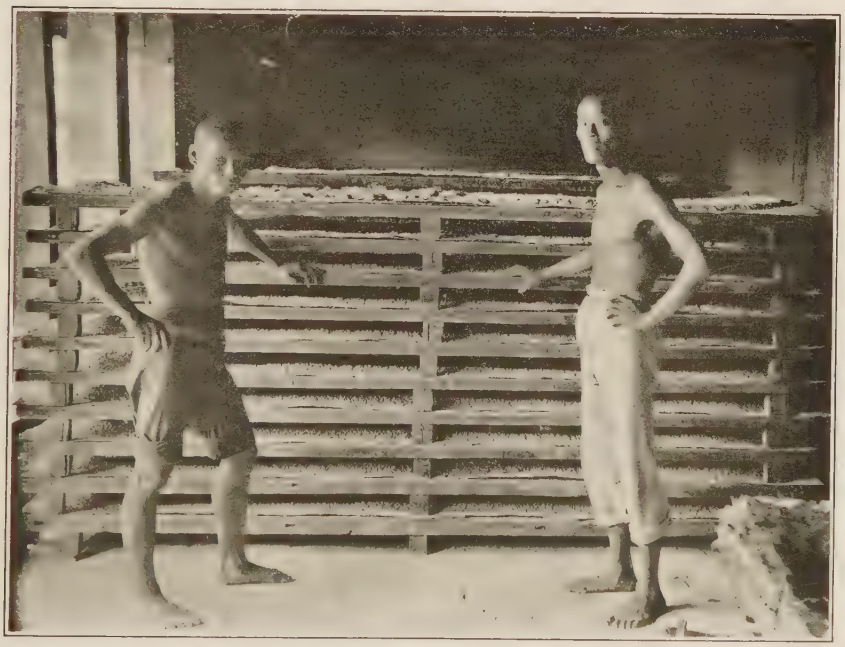

Fig. 2. Racks in the dark room.

PLATE II.

Fig. 1. Soy sauce being drawn by means of a siphon.

Fig. 2. The first drawing of soy.

PLATE III.

Fig. 1. A light frame, used in making soy.

Fig. 2. Bamboo baskets, in which boiled beans are cooled and drained.

PLATE IV.

Fig. 1. Conical bamboo covers.

Fig. 2. Soy-sauce jars.

PLATE V.

Fig. 1. Soy beans, natural size.

Fig. 2. Soy beans and flour, five days in the mold room.

PLATE VI.

Fig. 1. Circular bamboo trays.

Fig. 2. Soy sauce ready for shipment.

PLATE VII.

REVIEWS

The | Medical Clinics | of | North America | November, 1918 | published bi-monthly by | W. B. Saunders Company | Philadelphia and London | Pp. 645–920.

The Philadelphia Number, Volume II, No. 3, contains the following papers:

The influenza epidemics of 1889 and 1918, by Dr. Alfred Stengel.
Influenza and some of its complications, by Dr. H. R. M. Landis.
The surgical complications and sequelæ of influenza, by Dr. John B. Deaver.
Bacteriologic study of sputum in the recent epidemic, by Dr. Charles W. Burr.
Bacteriology of influenza, by Lieut. Eugene A. Case.
Nose, throat, and ear affections complicating or following the recent epidemic of so-called influenza, with a ventured interpretation of their significance, by Dr. J. Leslie Davis.
Influenza in children, by Dr. Maurice Ostheimer.
Feeding babies during their second year, by Dr. Maurice Ostheimer.
Sciatica, by Dr. Thomas McCrae.
Intraspinal therapy in syphilis, by Dr. Jay Frank Schamberg and Dr. Albert Strickler.
Chylothorax, by Elmer H. Funk.
Aortic aneurysm with esophageal rupture, by Elmer H. Funk.
Tuberculosis and pregnancy, by Elmer H. Funk.
Medical treatment of biliary affections, by Dr. Martin E. Rehfuss.
Dilatation of the colon in children, with especial reference to the idiopathic form, by Dr. J. P. Crozer Griffith.
Cerebral palsies of children, by Dr. Charles S. Potts.
Diabetes, by Dr. Leon Jonas.
X-ray diagnosis of lung diseases, by Dr. David R. Bowen.
Physiologic psychiatry, by Dr. S. D. W. Ludlum.
Influenza—Remarks upon symptoms, prevention, and treatment, by Dr. David Riesman.

Volume I September–December, 1918 Number 1 | Quarterly Medical Clinics | A Series of Consecutive Clinical Demonstrations and Lectures | by | Frank Smithies, M. D., F. A. C. P. | [four lines of titles] | Augustana Hospital | Chicago | published by | Medicine and Surgery Publishing Company, Inc. | Metropolitan Building | St. Louis | Paper, pp. 1–188, $1.50.

FROM THE PREFACE

For some time, it has been the practice to have a clerk report my Clinics and Lectures given at Augustana Hospital to the Senior Students of the School of Medicine of the University of Illinois. The notes taken by the clerk have been edited,

mimeographed and given to the students at each succeeding Clinic. This procedure has proved more valuable than when students themselves made notes. It has also enabled me to keep a record of the subjects presented, has avoided repetition and furnished a definite material from which examination questions might be selected.

Frequently, students and visiting physicians have suggested that the Clinics and Lectures be issued in consecutive order and in form more substantial than loose mimeographed sheets. Difficulties attendant upon such arrangement finally have been overcome and this volume contains the bulk of the clinical matter presented during the past three months. It is hoped that each quarter similar collections of Clinics and Lectures may be issued and that the venture may prove as useful to medical men, generally, as it has proved already to a limited group of students.

Ultra Violet Rays In | Modern Dermatology | Including the evolution of artificial | light rays and therapeutic | technique | by | Ralph Bernstein, M. D. | Philadelphia, Pa. | [eighteen lines of titles] | author of | "Elementary dermatology"—numerous | brochures on skin diseases, etc. | illustrated | Achey & Gorrecht | 5–9 North Queen Street | Lancaster, Pennsylvania | Cloth, pp. i-xiii + 1–162.

FROM THE PREFACE

The efficacy of ultra violet rays in the practice of dermatology is now thoroughly established, and its bactericidal action, its anti-pruritic and analgesic effects, as well as its reconstructive action upon epidermal cells and its constitutional effect upon the general economy, cannot now be denied.

The author has been prompted to write this book because no American author has heretofore attempted it, the profession relying entirely upon the writings of their European colleagues.

It is the author's intention to present the subject as briefly as possible with clearness, and with no intention of going into histo-pathologic details. The mere thought in mind will be to give in a practical way to the profession the results of his clinical experience with the use of ultra violet radiations in the treatment of the various skin diseases for which he has found the ultra violet light a desirable agent.

The author has thoroughly gleaned the literature of the day and hereby gives credit for the material which he has used therefrom to the foreign writings of Morris, Dore, Bach, Wagner, Kruger, and Blaschko, and to the following writers from our own continent: Martin, MacKee, Jordan, Plank, Collins, and Allen.